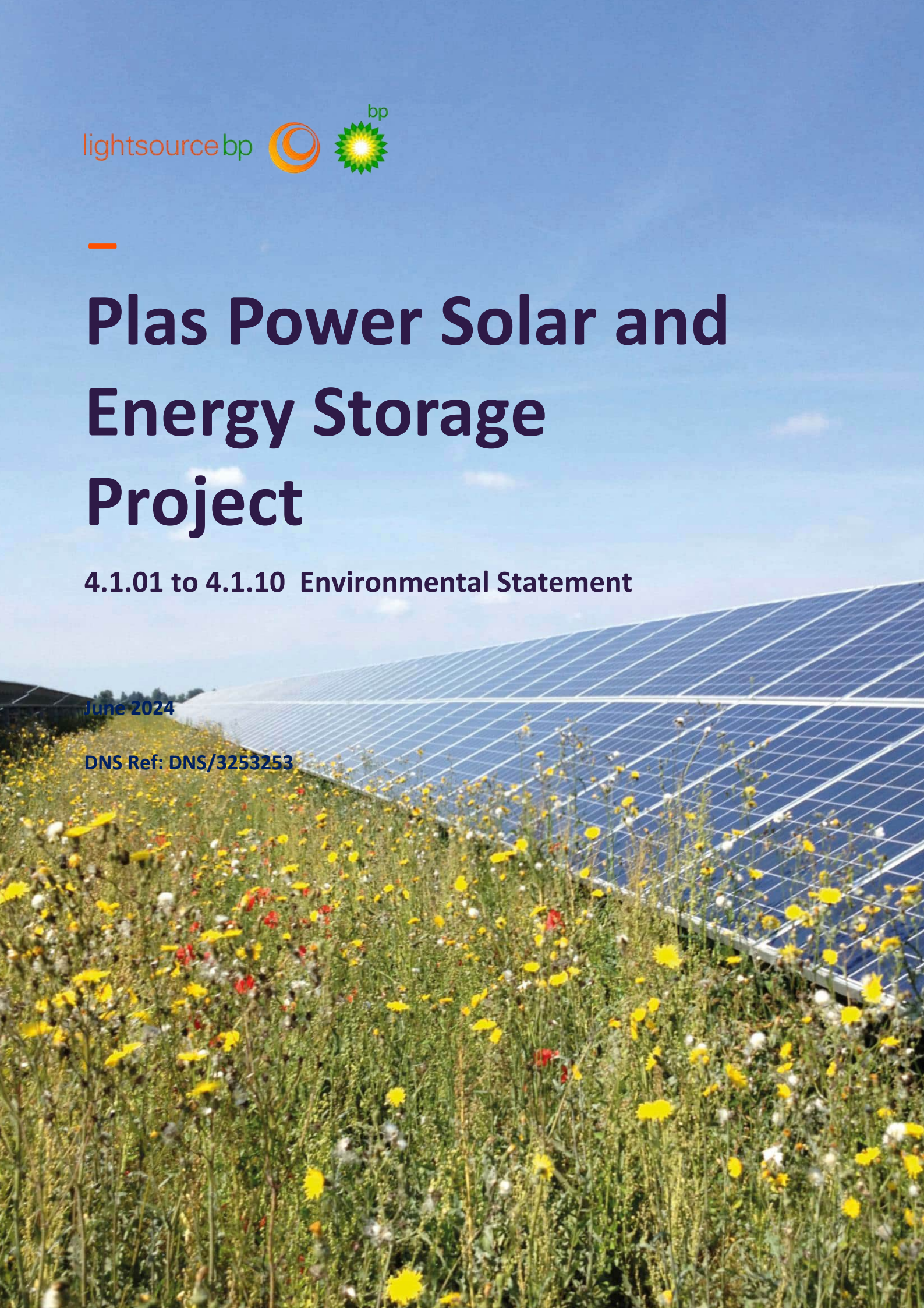


Plas Power Solar and Energy Storage Project

4.1.01 to 4.1.10 Environmental Statement

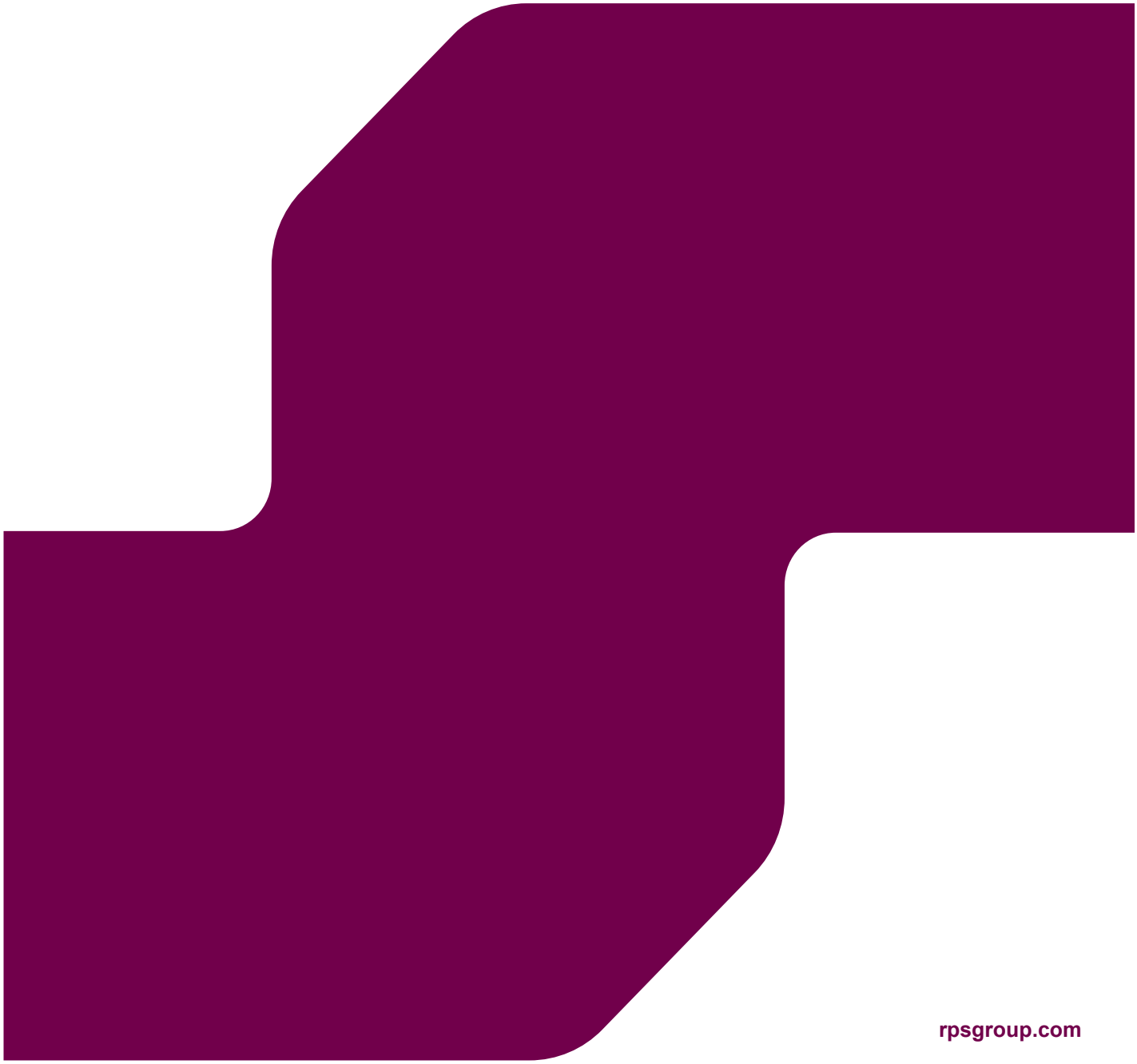
June 2024

DNS Ref: DNS/3253253

PLAS POWER SOLAR AND ENERGY STORAGE PROJECT

ENVIRONMENTAL STATEMENT

Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017



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GLOSSARY

Term	Definition
AC	Alternating Current
AEP	Annual Exceedance Probability
AGL	Above Ground Level
AIA	Arboricultural Impact Assessment
AIL	Abnormal Indivisible Loads
ALC	Agricultural Land Classification
AOD	Above Ordnance Datum
AONB	Area of Outstanding Natural Beauty
BAP	Biodiversity Action Plan
BESS	Battery Energy Storage Facility
BGS	British Geological Survey
BMS	Battery Management System
BMV	Best and Most Versatile Agricultural Land
BoCC	Birds of Conservation Concern
BoS	Balance of System
BPM	Best Practicable Means
CBD	Convention on Biological Diversity
CC	Climate Change
CCC	Climate Change Committee
CCS	Considerate Constructors Scheme
CdTe	Cadmium Telluride
CEH	Centre for Ecology & Hydrology
CEMP	Construction Environment Management Plan
CTMP	Construction Traffic Management Plan
CID	Current Interrupt Devices
CIEEM	Chartered Institute of Ecology and Environmental Management
CMRA	Coal Mining Risk Assessment
CO2	Carbon Dioxide
CO2e	Carbon Dioxide Equivalent
CPAT	Clwyd-Powys Archaeological Trust
CSM	Conceptual Site Model
CTMP	Construction Traffic Management Plan
c-Si	Crystalline Silicon
DAM	Development Advice Map
DAS	Design and Access Statement
DBEIS	Department for Business, Energy & Industrial Strategy
DCLG	Department for Communities and Local Government
DC	Direct Current
DEFRA	Department for Food and Rural Affairs
DESNZ	Department for Energy Security and Net Zero

Term	Definition
DETR	Department of the Environment, Transport and the Regions
DMRB	Design Manual for Roads and Bridges
DNS	Development of National Significance
DTS	Desktop Survey
ECoW	Ecological Clerk of Works
eDNA	Environmental Deoxyribonucleic Acid
EEA	European Economic Area
EIA	Environmental Impact Assessment
EPDs	Environmental Product Declarations
ES	Environmental Statement
FCA	Flood Consequences Assessment
FDSS	Fire Detection and Suppression Systems
FES	Future Energy Scenarios
FMfP	Flood Map for Planning
FSC	Forest Stewardship Council
G&G	Glint & Glare
GCN	Great Crested Newt
GHG	Greenhouse Gas
GIS	Geographic Information Systems
GLVIA	Guidance for Landscape and Visual Impact Assessment
$GtCO_2e$	Giga Tonnes Carbon Dioxide Equivalent
GWP	Global Warming Potential
H	High
HA	Hectares
HGV	Heavy Goods Vehicle
HM	His Majesty
HPI	Habitat of Principal Importance
HRA	Habitat Regulations Assessment
HSE	Health and Safety Executive
HSI	Habitat Suitability Index
HV	High Voltage
HVAC	Heating, Ventilation and Air Conditioning
HDD	Horizontal Directional Drilling
IAQM	Institute of Air Quality Management
IBCs	Intermediate Bulk Containers
IEA	International Energy Agency
IEF	Important Ecological Features
IEMA	Institute of Environmental Management
IROPI	Imperative Reasons of Overriding Public Interest
L	Long
LBAP	Local Biodiversity Action Plan
LCA	Landscape Character Area

Term	Definition
LDP	Local Development Plan
LEMP	Landscape and Ecology Management Plan
LGV	Light Goods Vehicle
LNR	Local Nature Reserves
LV	Low Voltage
LVIA	Landscape and Visual Impact Assessment
LWS	Local Wildlife Sites
LQAS	Land Quality Advice Service
MAFF	Ministry of Agriculture, Fisheries and Food
MOHC	Met Office Hadley Centre
MRA	Minerals Resource Assessment
MV	Medium Voltage
MW	Megawatt
MWac	Megawatt alternating current
MWh	Megawatt-hour
NDC	Nationally Determined Contribution
NG	National Grid
NLCA	National Landscape Character Areas
NMC	Nickel-Manganese-Cobalt
NNR	National Nature Reserves
NPRN	National Primary Record Number
NRW	Natural Resources Wales
NTS	Non-Technical Summary
NZW	Net Zero Wales
oBSMP	Outline Battery Safety Management Plan
oCEMP	Outline Construction Environmental Management Plan
oCTMP	Outline Construction Traffic Management Plan
OS	Ordnance Survey
oSRMP	Outline Soils Resource Management Plan
P	Pond
PAC	Pre-Application Consultation
PCS	Power Conversion System
PDAS	Planning, Design and Access Statement
PEA	Preliminary Ecological Appraisal
PEDW	Planning and Environment Decisions Wales
PFRA	Preliminary Flood Risk Assessment
PPG	Pollution Prevention Guidance
PPW	Planning Policy Wales
PRA	Preliminary Risk Assessment
PRoW	Public Right of Way
PTC	Positive Thermal Coefficient
PV	Photovoltaic

Term	Definition
RCP	Representative Concentration Pathway
RPZ	Root Protection Zones
RVAA	Residential Visual Amenity Assessment
SAC	Special Area of Conservation
SAM	Scheduled Ancient Monument
SM	Scheduled Monument
SMC	Scheduled Monument Consent
SPA	Special Protection Area
SPG	Supplementary Planning Guidance
SRMP	Soils Resource Management Plan
SSSI	Special Site of Scientific Interest
TAN	Technical Advice Note
TTA	Tactical Training Area
UK	United Kingdom
UNFCCC	United Nations Framework Convention on Climate Change
VP	Viewpoint
W	Wide
WBCSD	World Business Council for Sustainable Development
WCBC	Wrexham County Borough Council
WEEE	Waste Electrical and Electronic Equipment
WFD	Water Framework Directive
WG	Welsh Government
WRI	World Resources Institute
WS	Wildlife Site
WSI	Written Scheme of Investigation
UKCPP	UK Climate Projections Project
ZOI	Zone of Influence
ZTV	Zone of Theoretical Visibility

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1 INTRODUCTION

Introduction

1.1 This Environmental Statement ('ES') has been prepared by RPS on behalf of Lightsource SPV 192 Limited ('the Applicant'). The ES reports on the findings of the Environmental Impact Assessment ('EIA') process and accompanies the planning application for the Plas Power Solar and Energy Storage Project (herein referred to as the 'Proposed Development'). The Proposed Development includes the construction and operation of a solar photovoltaic electricity generating station ('solar farm'), a Battery Energy Storage System ('BESS') and associated ancillary development. The solar element of the Proposed Development is anticipated to have an export capacity of 57 megawatt, alternating current (MWac) and the BESS will have an installed capacity of 57MWac. At the end of the Proposed Developments 40-year life it will be decommissioned, dismantled and removed with the site being restored.

1.2 The Proposed Development site (the 'site') is located on the Plas Power Estate, Ruthin Road, Wrexham, approximately 2.5 km to the west of Wrexham city centre. It is wholly within the administrative boundary of Wrexham County Borough Council ('WCBC'). The site location is shown on **Figure 2.1** Site Location Plan.

1.3 The Proposed Development would comprise the following elements:

- Solar arrays comprising solar panels and frames;
- Inverters;
- Transformers;
- Cabling;
- Substations;
- BESS;
- Ancillary infrastructure, including storage containers;
- Internal access tracks; and
- Landscaping and ecological enhancement areas.

Statutory Framework and Purpose of the Environmental Statement

The Developments of National Significance (Wales) Regulations 2016

1.4 As the scheme comprises an electricity generating station with a generating capacity between 10MW and 350MW, it falls within the definition of a 'Development of National Significance' (DNS) under regulations 3 and 4 of The Developments of National Significance (Specified Criteria and Prescribed Secondary Consents) (Wales) Regulations 2016 (as amended).

1.5 Part 5 of the Planning (Wales) Act 2015 set out DNS as a new category of planning application. Following the entry into force of the relevant provisions in the Act in March 2016, Planning and Environment Decisions Wales (PEDW) manages the DNS process on behalf of the Welsh Government. Future Wales: The National Plan 2040 (February 2021) together with the relevant Local Development Plan (LDP) and any relevant Strategic Development Plan is the development plan for DNS decision-making purposes. Section 61Z of the Town and Country Planning Act 1990

and regulation 7 of the Developments of National Significance (Procedure) (Wales) Order 2016 requires the Applicant to carry out pre-application consultation before submitting the planning application to PEDW. The purpose of the DNS process is to ensure timely decisions are made on those planning applications that are of greatest significance to Wales because of their potential benefits and/or impacts.

Purpose of EIA

1.6 EIA is a means of identifying and collating information to inform an assessment of the likely significant environmental effects of a project. The findings of the EIA process are reported in an ES in order to inform the relevant decision-maker and interested parties as part of the decision-making process.

The EIA Regulations

1.7 Following the UK's exit from the EU, the previous legislative framework for EIA set under the EIA Directive has been superseded by the Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017. These regulations are referred to in this ES as 'the EIA Regulations'.

Need for EIA

1.8 Schedule 1 of the EIA Regulations identifies development types that always require EIA. Schedule 2 identifies development types that require EIA if they are likely to lead to significant effects on the environment by virtue of factors such as their nature, size or location. Schedule 2 development is defined within the EIA Regulations as development of a description mentioned in Column 1 of the table in Schedule 2 where:

'a) any part of that development is to be carried out in a sensitive area; or

b) any applicable threshold or criterion in the corresponding part of Column 2 of that table is respectively exceeded or met in relation to that development.'

1.9 The Proposed Development falls within the description at paragraph 3(a) 'Industrial installations for the production of electricity, steam and hot water (unless included in Schedule 1)' in Column 1 of the table in Schedule 2 to the Regulations. Schedule 2 development requires screening against the criteria set out in Schedule 3 of the Regulations. The criteria include the characteristics of the development, location of development and types and characteristics of the potential impacts.

1.10 The Proposed Development falls under Schedule 2 given that it would exceed the relevant threshold within Schedule 2 with a development area exceeding 0.5 hectares (for industrial installations for the production of electricity, steam and hot water).

1.11 As stated above, Schedule 2 development requires EIA to be undertaken where a project is likely to have significant effects on the environment by virtue of factors such as its nature, size or location. Taking into account the nature and scale of the Proposed Development, with the development area of 136 hectares (ha) exceeding the 0.5 ha threshold, together with the location, EIA has been undertaken in this instance, although a number of topic-specific assessments have been scoped out.

1.12 A notification of intention to submit a Development of National Significance (DNS) was sent to Welsh Ministers on 3 October 2023. On 6 October 2023, PEDW (formerly the Planning Inspectorate (PINS)) confirmed that the Proposed Development was a DNS application. A Screening Direction Request (**Appendix 1.1**) was submitted to the Planning Inspectorate (now PEDW) on 27 May 2020.

On 1 July 2020, the Planning Inspectorate issued a Screening Direction (**Appendix 1.2**) to confirm that the proposed development is EIA development within the meaning of the EIA Regulations.

1.13 A Scoping Direction was sought from Welsh Ministers in October 2020 for a previous iteration of the Proposed Development which had a different red line boundary extent. A Scoping Direction was issued by PINS (now PEDW) in December 2020 (**Appendix 4.2**). As a result of the amendment to the red line boundary, an updated EIA Scoping Report was submitted to PEDW in June 2023 to confirm that the scope of the EIA remained appropriate, and a Scoping Direction Addendum was issued by PEDW in October 2023 (**Appendix 4.4**).

1.14 Further details in relation to this are provided in Chapter 4: Environmental Assessment Methodology.

Content of the ES

1.15 This ES has been prepared in accordance with the EIA Regulations. Although there is no statutory provision as to the form of an ES, it must contain the information specified in Regulation 17 and Schedule 4 of the EIA Regulations. For the avoidance of doubt, the specified information within Regulation 17 and Schedule 4 is provided in **Appendix 1.3** of this ES.

1.16 Schedule 4 of the EIA Regulations sets out the information required for inclusion in ESs. **Table 1.1** below sets out the information required under Schedule 4 of the EIA Regulations together with an indication of where this is addressed in the ES.

Table 1.1: Information Required for Inclusion in ES

Information for inclusion in ES	Where addressed
1. A description of the development, including in particular— a. a description of the location of the development b. a description of the physical characteristics of the whole development, including, the land-use requirements during the construction and operational phases c. a description of the main characteristics of the operational phase of the development d. an estimate of expected residues and emissions and quantities and types of waste produced during the construction and operational phases	Please refer to Volume 1, Chapter 2: Project Description of the ES.
2. A description of the reasonable alternatives studied by the applicant which are relevant to the proposed development and its specific characteristics and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects.	Please refer to Volume 1, Chapter 3: Need and Alternatives Considered of the ES.

Information for inclusion in ES	Where addressed
3. A description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof without implementation of the development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge.	Please refer to the description of the environmental baseline conditions under each topic chapter, together with information contained within Volume 1, Chapter 3: Need and Alternatives Considered of the ES, and Volume 1, Chapter 4: Environmental Assessment Methodology of the ES.
4. A description of the factors likely to be significantly affected by the development: population, human health, biodiversity, land, soil, water, air, climate, material assets, cultural heritage and landscape.	Please refer Chapter 4: Environmental Assessment Methodology and relevant discussion in each topic chapters: Volume 1, Chapter 5: Landscape and Visual Impact Assessment of the ES Volume 1, Chapter 6: Biodiversity of the ES Volume 1, Chapter 7: Cultural Heritage of the ES Volume 1, Chapter 8: Hydrology and Hydrogeology of the ES Volume 1, Chapter 9: Climate Change of the ES Volume 1, Chapter 10: Soils of the ES
5. A description of the likely significant effects of the development on the environment resulting from, inter alia— a. the construction and existence of the development, b. the use of natural resources in particular land, soil, water and biodiversity, considering as far as possible the sustainable availability of these resources c. the emission of pollutants, noise, vibration, light, heat and radiation, the creation of nuisances and the disposal and recovery of waste d. the risks to human health, cultural heritage or the environment e. the cumulation of effects with other existing and/or approved projects	Please refer to the assessment of effects under each topic chapter.

Information for inclusion in ES	Where addressed
f. the impact of the project on climate and the vulnerability of the project to climate change g. the technologies and the substances used. The description of the likely significant effects should cover the direct effects and any indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the development.	
6. A description of the forecasting methods or evidence used to identify and assess the effects on the environment, including details of the difficulties encountered compiling the required information and the main uncertainties involved.	Please refer to Volume 1, Chapter 4: Environmental Assessment Methodology of the ES and the relevant Methodology sections under each topic chapter including the Limitations and Assumptions discussion.
7. A description of the measures envisaged to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on the environment and any proposed monitoring arrangements. That description should explain the extent, to which significant adverse effects on the environment are avoided, prevented, reduced or offset, and should cover both the construction and operational phases.	Please refer to **Table 2.4** and **Table 2.5** together with detail contained in the Mitigation section under each topic chapter.
8. A description of the expected significant adverse effects of the development on the environment deriving from the vulnerability of the development to risks of major accidents and/or disasters which are relevant to the project concerned.	Please refer to the assessment of effects under each topic chapter.
9. A non-technical summary of the information provided under paragraphs 1 to 8.	Please refer to ES Non-Technical Summary.
10. A reference list detailing the sources used for the descriptions and assessments included in the ES.	Please refer to reference sections at each chapter of this ES.

1.17 Regulation 17 of the EIA Regulations sets out the information required to accompany an EIA application. **Table 1.2** below sets out the information required under Schedule 4 of the EIA Regulations together with an indication of where this is addressed in the ES.

Table 1.2: Information Required to Accompany an EIA Application

Information for inclusion in ES	Where addressed
3. An ES is a statement which includes at least— (a) a description of the proposed development comprising information on the site, design, size and other relevant features of the development; (b) a description of the likely significant effects of the proposed development on the environment; (c) a description of any features of the proposed development, or measures envisaged in order to avoid, prevent or reduce and, if possible, offset likely significant adverse effects on the environment; (d) a description of the reasonable alternatives studied by the applicant or appellant, which are relevant to the proposed development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the significant effects of the development on the environment; (e) a non-technical summary of the information referred to in sub-paragraphs (a) to (d); and (f) any additional information specified in Schedule 4 relevant to the specific characteristics of the particular development or type of development and to the environmental features likely to be significantly affected.	Please refer to: (a) Chapter 2: Project Description. (b) Topic Chapters 5 to 10. (c) Chapter 2: Project Description. (d) Chapter 3: Need and Alternatives Considered. (e) Volume 3 of the ES: Non-Technical Summary. (f) **Table 1.1** above.
4. An ES must— (a) be prepared by persons who in the opinion of the relevant planning authority or the Welsh Ministers, as appropriate, have sufficient expertise to ensure the completeness and quality of the statement; (b) contain a statement by or on behalf of the applicant or appellant describing the expertise of the person who prepared the ES; (c) where a scoping opinion or direction has been issued in accordance with regulation 14 or 15, be based on the most recent scoping opinion or direction issued (so far as the proposed development remains materially the same as the proposed development which was the subject of that opinion or direction); (d) include the information reasonably required for reaching a reasoned conclusion on the significant	Please refer to: (a) **Appendix 1.4** Statement of Expertise. (b) **Appendix 1.4** Statement of Expertise. (c) **Appendix 4.4** and relevant discussion throughout this ES. (d) Relevant discussion throughout this ES. (e) Paragraphs 1.4 to 1.8 which set the legislative framework and relevant

Information for inclusion in ES	Where addressed
effects of the development on the environment, taking into account current knowledge and methods of assessment; and (e) take into account other relevant environmental assessments required under Union legislation or any other provision of domestic legislation, with a view to avoiding duplication of assessment.	discussion in topic Chapters 5 to 10.

1.18 Regulations 18 and 21 of the EIA Regulations sets out the procedure where an ES is submitted to the Welsh Ministers. This DNS application has met all relevant procedural requirements under Regulations 18 and 21.

1.19 This ES provides all information required under Regulation 17 and Schedule 4. The information supplied within this ES is considered to provide a clear understanding of the likely significant effects of the Proposed Development upon the environment, and the likely residual effects having regard to the mitigation proposed, taking account of the fact that effects will be both negative and positive.

Structure of the ES

1.20 The ES has been structured in order to allow relevant environmental information to be easily accessible. This volume of the ES (Volume 1) includes the main text of the ES. A description of the project is provided in Volume 1, Chapter 2: Proposed Development Description . Information relating to the main alternatives considered during the evolution of the Proposed Development and the reasons for the choices made is found within Volume 1, Chapter 3: Need and Alternatives Considered. Volume 1, Chapter 4: Environmental Assessment Methodology outlines the approach and methodology adopted for the EIA. The remainder of Volume 1 contains topic by topic environmental information as shown in **Table 1.3**.

1.21 Figures and appendices to accompany the text of the ES are provided separately in Volumes 2 and 3. Volume 3 includes specialist reports providing relevant background and technical information. A Non-Technical Summary (NTS) is available as a separate summary document as part of the application.

Table 1.3: Structure of ES

Structure of ES	
Non-Technical Summary	Summary of the ES using non-technical terminology
Volume 1: Text	
	Glossary
Chapter 1	Introduction
Chapter 2	Project Description
Chapter 3	Need and Alternatives Considered
Chapter 4	Environmental Assessment Methodology
Chapter 5	Landscape and Visual
Chapter 6	Biodiversity
Chapter 7	Cultural Heritage
Chapter 8	Hydrology and Hydrogeology
Chapter 9	Climate Change

Structure of ES	
Chapter 10	Soils
Volume 2: Figures	
Including all figures and drawings to accompany the text.	
Volume 3: Appendices	
Including specialist reports forming technical appendices to the main text.	

The Applicant

1.22 The Applicant is Lightsource SPV 192 Limited ('Lightsource bp'). Lightsource bp is a global leader in the development, financing, build and operation of utility-scale solar energy projects. Its projects generate competitively priced, dependable, clean energy for businesses and communities.

1.23 Lightsource Renewable Energy was established in 2010 and has developed significant expertise in the UK renewable energy sector. In 2017 Lightsource partnered with bp in a 50:50 joint venture, becoming Lightsource bp.

The Assessment Team

1.24 The EIA has been managed by RPS, taking into account information provided by the Applicant and design team. RPS is a registrant of the Institute of Environmental Management and Assessment (IEMA) Quality Mark. All authors of this ES are senior members of RPS, and a statement setting out how the authors have sufficient expertise to ensure the completeness and quality of the ES is provided in **Appendix 1.4**.

Further Information

1.25 This ES is submitted as part of a planning application for the proposed Plas Power Solar and Energy Storage Project. The application is submitted to PEDW. The submitted planning application, ES and NTS will be able to be viewed at:

Wrexham County Borough Council
Guildhall
Wrexham
LL11 1AY

1.26 Copies of the ES and planning application documents will also be able to be viewed on the PEDW DNS website:

https://gov.wales/developments-national-significance-dns-applications

1.27 The full ES will also be published online at:

https://lightsourcebp.com/uk/project/plas-power/

https://lightsourcebp.com/uk/project/plas-power-cymraeg/

1.28 Further copies of the ES can be obtained from the following address:

RPS
2 Callaghan Square
Cardiff
CF10 5AZ

1.29 A paper copy of the full ES can be obtained for a cost of £250 plus VAT or an electronic copy for a cost of £10.

1.30 All comments on the ES (and planning application) should be issued to PEDW. Further detail on how to comment can be found via the Planning Casework service at:

https://planningcasework.service.gov.wales/

2 PROPOSED DEVELOPMENT DESCRIPTION

Introduction

2.1 This chapter provides a description of the Proposed Development and forms the basis for the environmental assessment provided in this ES. Further information can be found in the appendices to this chapter provided in **Volume 3** of this ES.

2.2 The effects of the Proposed Development have been assessed throughout the ES based on what is likely. For example, construction information is presented as the 'likely worst case'. A number of measures which would reduce or avoid adverse environmental effects arising have been included as part of the project design. Details of these measures are provided in this chapter and set out in each topic chapter as necessary. This chapter, together with the subsequent topic chapters, provide the data required to identify and assess the likely significant effects of the Proposed Development in accordance with Regulation 17 and Schedule 4 of the EIA Regulations.

2.3 This chapter provides a description of the site and the key components of the Proposed Development, including an overview of the approach to construction.

The Site and Surrounding Area

Site Location

2.4 The application site (the "site") covers approximately 136 hectares (ha) and is located wholly within the administrative boundary of WCBC. The site is approximately 2.5 km to the west of Wrexham town city centre (see **Figure 2.1 –** Site Location Plan (Drawing no: JPW1473-DNS-007).

2.5 The site comprises two interconnected areas north and south of the A525 Ruthin Road. The southern and larger part of the site is bound by the A525 Ruthin Road to the north, to the east by the A483, to the south by Plas Power Woods and its westernmost point by agricultural fields beyond which lies Rhos Berse Road and Nant Road. The northern parcel is bound by the A525 Ruthin Road to the south and extends northwards towards Higher Berse Road. Coedpoeth lies approximately 120m to the west and New Broughton lies approximately 600m north-west of the site. The site comprises several agricultural fields, primarily used for pasture grazing, bound by a mixture of mature woodland, trees, hedgerows, fencing, agricultural tracks and roads.

2.6 The Proposed Development will include a 33kV cable that will connect the solar farm, BESS and associated infrastructure to the existing Legacy Substation located approximately 1.2km to the south-west of the site, north of the B5246 Bronwylfa Road. There is currently a Preferred Cable Route Option and three other route options for the cable route under consideration. Each of the cable route options are assessed within this ES. All options will route south of the site before joining the Plas Buckley Road and following the existing unnamed road west to the north of Cadwgyn Hall, before connecting to Legacy Substation. The Preferred Cable Route Option would pass to the north of Cadwgan Hall continuing along the Plas Buckley Road whilst Cable Route Option 1 would pass to the south of Cadwgyn Hall through agricultural fields, before connecting to Legacy Substation. Cable Route Option 2 and Cable Route Option 3 provide a short alternative route to connect from Plas Buckley Road to the south of the site.

2.7 The site formed part of an open cast mine in 1964 and subsequently a non-water fill in 1976. The site is currently used for agricultural purposes, comprising of agricultural fields, primarily used for pasture grazing, bound by a mixture of mature woodland, trees, hedgerows and fencing. Parts of

the northern parcel comprise arable land for the purpose of growing potato crops. The Proposed Development would support the continued use of the land for sheep grazing.

Geology and Topography

2.8 The geology of the site comprises a cover of Glacial Superficial deposits of either Glacial Till or Glaciofluvial sands and gravels overlying bedrock strata of the Pennine Lower and Middle Coal Measures. Cefn Rock sandstone is present in the northernmost part of the site. Whilst the site is located within a Mineral Resource Area, these deposits are recorded to extend significantly beyond the site boundary. A Minerals Resource Assessment (MRA) is included at **Appendix 4.8** and has been undertaken to assess the impact of the Proposed Development upon the resources present.

2.9 The topography of the site, based upon Ordnance Survey 1:10,000 mapping contours, generally falls from a high point of 180 meters above ordnance datum (mAOD) within the north-western extent of the northern parcel of the site to approximately 102mAOD within the south-eastern extent of the southern land parcel.

Site History

2.10 The presence of shallow coal seams has resulted in the use of much of the site, particularly in the east (Plas Power Park opencast site) and south (Cadwgan), for historical opencast extraction, resulting in the backfill and restoration of areas which were excavated to approximately 10 to 13m depth.

2.11 The site is currently used for agricultural purposes, comprising of several agricultural fields, primarily used for pasture grazing, bound by a mixture of mature woodland, trees, hedgerows and fencing.

Planning Context

2.12 As the site lies within the administrative boundary of WCBC, the Development Plan for the purposes of Section 38(6) of the Planning and Compulsory Purchase Act 2004 comprises of:

- Future Wales: The National Plan 2040 published February 2021; and
- Wrexham Local Development Plan 2013 – 2028 adopted December 2023 (LDP).

2.13 The LDP Proposals and Constraints Map indicate the site is not allocated for any specific use. However, it is affected either in whole or in part by the following designations:

- Sand and Gravel Safeguarding Area (Policy SP16 and Policy MW1)
- Non-Energy Minerals Extraction Exclusion Area (Policy SP16 and Policy MW3)
- Welsh Language Sensitive Area (Policy WL1)

2.14 The ES provides an overview of relevant legislative and planning policy context within each topic chapter. The assessments have regard to national and local policy documents, as relevant to that topic.

2.15 The ES does not include a separate chapter on planning policy context. The draft guidance on EIA from the Department for Communities and Local Government 'EIA: A Guide to Good Practice and Procedures' (DCLG 2006) (paragraph 155) states that there is no requirement to provide chapters on planning and sustainability in ESs.

2.16 A separate Planning, Design and Access Statement has been submitted in support of the DNS application.

Proposed Development Description

Key Components

2.17 The Proposed Development is for a solar project with a BESS. The Proposed Development will consist of the construction of solar panels mounted on metal frames, new access tracks, underground cabling, perimeter fencing with CCTV cameras, switchgear substations, inverters, transformer stations, auxiliary transformers, permanent storage containers, monitoring houses, a BESS and all ancillary grid infrastructure and associated works. It will also include landscaping and ecological enhancement areas (refer to **Figure 2.2a** – Indicative Site Layout Plan (Drawing no: LP2-PDL). The solar element of the Proposed Development is anticipated to have an export capacity of 57MWac and the BESS will have an installed capacity of 57MWac. The Proposed Development will include a 33kV cable that will connect the solar, BESS and associated infrastructure to the Legacy Substation located approximately 1.2km to the south-west of the site, north of the B5246 Bronwylfa Road.

2.18 The main components of the Proposed Development are:

- Solar arrays comprising solar panels and frames;
- Inverters;
- Transformers;
- Cabling;
- Substations;
- BESS;
- Ancillary infrastructure, including storage;
- Internal access tracks; and
- Landscaping and ecological enhancement areas.

2.19 Key parameters for the Proposed Development are detailed below.

Solar Arrays

2.20 Solar panels, also known as photovoltaic panels (PV), are made up of cells, which convert the light energy from daylight into electrical energy.

2.21 The solar panels will be attached to metal frames or mounting structures which together form PV tables (or modules). The PV tables will be fixed to pile driven galvanised steel posts. The frames are typically made of galvanised steel or zinc, magnesium or aluminium alloy coating and will have a rough matt finish, rather than a polished finish. The base of the frame piles are thin ‘H’ or ‘C’ shapes, thus they have very little impact on the ground and do not require any prior excavation. The frames are driven to a depth of a minimum of 1.5-2m depending on ground conditions. When the site is decommissioned, the frame piles are simply pulled out from the ground causing minimal ground disturbance. No concrete foundations are required for the frames, however in some instances it may be necessary to use concrete bases or ‘feet’ where the ground conditions are not suitable for piling, or if there is an area of archaeological sensitivity. The concrete bases sit on top of the ground so as not to disturb anything below ground which also makes them easy to remove when decommissioning

the site (refer to **Figure 2.3** – Indicative Panel Elevation with Concrete Feet (Drawing no: FT-2P-25-6854-cf) for further details).

2.22 The frames will allow the panels to be positioned at an angle of between 15-25 degrees from the horizontal axis and orientated to the south, typically the height of a panel will be up to approximately 3.055m to the top of the panel frame on level ground, including up to approximately 1m of ground clearance to enable maintenance access and continued sheep grazing below the PV modules (refer to **Figure 2.4** – Indicative Panel Elevation (Drawing no: FT-2P-25-6854) for further details). However, subject to the topography, the height of the panel could be up to approximately 3.20m high.

2.23 A solar panel array will comprise of multiple rows of solar panels running east to west. Between each row of solar panels there would be a gap of approximately 2-2.5m to avoid overshadowing from one solar row to another. A 2.5m distance is assessed within this ES.

2.24 The solar panels will be set back from the site boundaries to allow for landscaping and screen planting, perimeter security fencing, CCTV coverage, access tracks and maintenance access, as well as to accommodate ecological receptors as necessary.

Inverters, Transformers and Switchgear Substations

2.25 The Applicant is currently considering two inverter options:

- String inverters; or
- Central inverters.

2.26 The inverters are required to convert the Direct Current (DC) electricity generated by the panels, to Alternating Current (AC) which is compatible with the wider UK grid network. From the inverters, the electricity flows to a transformer which ‘steps-up’ the voltage of the electricity from low voltage (LV) to medium voltage (MV) before it reaches the switchgear substations. The switchgear substations include a ‘switch’ mechanism to shut parts or all of the solar farm off from the wider network in the event of a fault (similar to a household fuse box).

2.27 String inverters would be mounted onto support frames whilst central inverters would be situated in pairs at regular intervals throughout the site. Central inverters are larger and comprise containerised units, as shown in grey on the site layout and will measure up to approximately 8.2m long (L), 2.3m wide (W) and 2.8m high (H) (including the base). 26 inverters are required. For the purpose of the EIA, central inverters are assumed to be included representing a worst-case both in terms of scale and noise source.

2.28 The proposed transformers will be up to approximately 5.5m (L), 4.5m (W) and 3.2m (H), these are an ‘open air’ design, surrounded by a fence and accompanied by a switchgear substation. The switchgear substations will be up to 4.2m (L), 2.6m (W) and 3.15m (H) (including the base). 26 transformers are required, and 14 switchgear substations.

2.29 The inverters, transformers and switchgear substations will be sited on a hardcore base. Refer to **Figure 2.5** – Inverters (Drawing no: GBR_EPD_INV), **Figure 2.6** – Transformers (Drawing no: GBR_EPD_TFM) and **Figure 2.7** – Switchgear Substations (Drawing no: GBR_EPD_SWG) for further details.

2.30 The electricity generated across the site, will be cabled to the customer substation to the south of the site (location shown in **Figure 2.2a**). All cabling will be routed underground.

Auxiliary Transformer

2.31 There will be one auxiliary transformer located within the site adjacent to the customer substation in the south-west of the site (as described further in paragraph 2.34 below). This will be up to approximately 3.8m (L) x 3.8m (W) 3.2m (H). The auxiliary transformer will provide low voltage electricity supply to ensure the safe and secure operation of the site. Refer to **Figure 2.8** – Auxiliary Transformer (Drawing no: GBR_EPD_AUX) for further details.

Substations

2.32 All electricity from across the solar PV arrays will collect at a substation (referred to as the 'PV Intake Substation') which will be installed to the south-west of the site.

2.33 A further BESS Intake Substation will be located in the BESS compound as described below. Both the PV Intake and BESS Substations connect into the Customer Substation which will be owned, operated and maintained by the operator. From here, a high voltage (HV) cable buried underground, will connect the solar farm to the existing grid network.

2.34 The PV Intake Substation will be up to approximately 10.5m (L) x 2.5m (W) 3.1m (H) (including the base). Refer to **Figure 2.9** – PV Intake Substation (Drawing no: GBR_EPD_PVI) for further details.

2.35 The customer substation will be up to approximately 10.3m (L) x 5.0m (W) 3.9m (H) (including the base). Refer to **Figure 2.10** – Customer Substation (Drawing no: GBR_EPD_CSS) for further details.

Glass Reinforced Plastic (GRP) Substation

2.36 The Glass Reinforced Plastic (GRP) cabinet supplies low-voltage power to the Battery Storage systems, facilitating ventilation and refrigeration for the battery units. Its GRP structure offers a more compact footprint compared to the brick building option and will be 3.00m (L) x 3.00m (W) x 2.55m (H). Refer to **Figure 2.11** – GRP Substation (Drawing no: GBR_EPD_GRP) for further details.

Monitoring House

2.37 A monitoring house is required to enable remote monitoring of the solar PV site. This building is typically up to approximately 3.9m (L) x 3.2m (W) and 3.3m (H) (including the base). This building will provide daily information/data in relation to the operation of the solar farm. During a solar farm's operation, data communication is vital to facilitate information flow from equipment such as inverters to a central control centre and alert the Applicant to any potential operational issues with the solar farm and or battery storage compound. In addition to this an up to approximately 5.05m (above ground level) weather station attached to the outside of the building is proposed to monitor wind speed, direction, and temperature. Refer to **Figure 2.12** – Monitoring House (Drawing no: GBR_EPD_MH/CB) for further details.

2.38 A further Monitoring House will be located in the BESS compound as detailed below.

Spares Container

2.39 It is proposed that one permanent spares container will be located within the site to store miscellaneous spare parts. This unit will measure approximately 12.4m (L) x 2.6m (W) x 2.9m (H). Refer to **Figure 2.13** – Spares Container 40ft (Drawing no: GBR_EPD_S40) for further details.

2.40 A further Spares Container will be located in the BESS compound as detailed below.

Battery Energy Storage System (BESS)

2.41 The BESS allows for surplus energy generated at times of high production to be stored and dispatched to the grid at times when the energy is needed. The BESS therefore contributes to balancing the intermittent energy production and maximises the site's efficiency to allow a greater output of clean energy.

2.42 The BESS will be located to the south of the site, close to the infrastructure associated with the solar farm, and away from residential properties and sensitive viewpoints.

2.43 The BESS will comprise batteries, combined Power Conversion Systems (PCS), a BESS Intake substation, and associated infrastructure.

2.44 The overall BESS layout is shown on **Figure 2.14** – Indicative BESS Layout (Drawing no: BESS_LYT) and will comprise the following components as set out in **Table 2.1** below.

Table 2.1: BESS Components

BESS Component	Maximum Approximate Dimensions	Figure
14 x 4 BESS Enclosures	16.62m (L) x 3.88m (W) x 3.0m (H)	**Figure 2.15** (Drawing no: K_EPD_BSS)
14 x BIC (Battery Interface Cabinet)	2.2m (L) x 1.1m (w) x 2.3m (H)	**Figure 2.16** (Drawing no: GBR_EPD_BIC)
7 x Twin MV	13.37 (L) x 6.9m (W) x 3.96m (H)	**Figure 2.17** (Drawing no: UK_EPD_TWS-NR)
1 x BESS Backup Generator	6.3m (L) x 2.64m (W) x 2.89m (H)	**Figure 2.18** (Drawing no: GBR_EPD_G20)
1 x BESS Spares Container	6.3m (L) x 2.64m (W) x 2.9m (H)	**Figure 2.19** (Drawing no: GBR_EPD_S20)
1x BESS Intake Substation	15.70m (L) x 3.00m (W) x 3.60m (H)	**Figure 2.20** (Drawing no: GBR_EPD_BIS)
1x BESS Monitoring House	3.86m (L) x 3.2m (W) x 3.3m (H)	**Figure 2.12** (Drawing no: GBR_EPD_MH/CB)

2.45 There will be security fencing around the BESS compound which will function to restrict unauthorised access into the compound and to deter theft or vandalism. Fencing is typically welded mesh up to approximately 2.5m high with metal posts (**Figure 2.21** – BESS Security Fencing (Drawing no: GBR_EPD_BSF)), combined with CCTV. The BESS CCTV cameras will be as per the CCTV for the rest of the site with the exception that they will be circa 3.5m high on galvanised steel posts rather than ranging from 2.5m – 3.0m in height. Refer to **Figure 2.22** – BESS CCTV (Drawing no: GBR_EPD_BCC) for further details. There will be up to 7 CCTV posts surrounding the BESS.

2.46 A gate will be located at the access point to the BESS and will be integrated into the security fencing. The gate will be up to approximately 2.5m high. Refer to **Figure 2.23** – BESS Gate (Drawing no: GBR_EPD_BSG) for more details.

2.47 The BESS will include lighting columns adjacent to each BESS enclosure. There will be 28 individual lighting columns each with a height of 3.86m. Refer to **Figure 2.24** - BESS Lighting Pole (Drawing Number: GBR_EPD_BLG) for further details.

Option to replace BESS with solar panels

2.48 As described within this chapter, the BESS is part of the Proposed Development and has therefore been assessed as such within the technical environmental assessments contained within this ES. If

the construction of the BESS were not to take place, the land where the BESS is currently proposed would be used to place solar panels instead. **Figure 2.2b** (drawing number: LP2-PDL-S) illustrates the alternative layout should the BESS not be constructed, highlighting where the solar panels would be situated. The technical environmental assessments contained within ES chapters 5-9 have assessed the Proposed Development in the context of the BESS being included as part of the design. In the scenario that the BESS is not built out and this land is used for additional solar panels instead, the environmental effects would be equal to or less than those currently presented within the technical chapters that are associated with the BESS in this location. As a result, the assessments as they are currently assessed present a worst-case scenario and therefore allow the flexibility for either option to be brought forward in the future. This approach and conclusion is confirmed within each technical ES chapter (5-10).

Security Fencing and Gates

2.49 The Proposed Development will be secured by perimeter fencing. This will be deer fencing with wooden posts at circa 3.5m centres. The fence will be approximately 2m high with small mammal gates fitted at appropriate points to enable free access into and out of the site (see **Figure 2.25**). – Security Fencing (Drawing no: GBR_EPD_FNC)).

2.50 The security fencing will function to restrict unauthorised access into the site and to deter theft or vandalism. Deer fencing has been selected due to its relative visual permeability and minimal impact on natural surface water flows. A minimum distance of 3m will be maintained between the security fencing and the solar arrays.

2.51 Gates will be located at each of the access points around the site. Each gate will be up to approximately 2m high and 5m wide. Refer to **Figure 2.26** – Gates (Drawing no: GBR_EPD_GTD) for more details.

CCTV and Infra-red Lighting

2.52 CCTV cameras will be carefully positioned around the periphery of the site. These cameras will be up to circa 2.5-3.0m high on galvanised steel posts and will be directed into the solar PV areas. They will use passive infra-red technology, thereby avoiding the need for lighting. These will enable remote surveillance of the site. Refer to **Figure 2.27** – Solar CCTV (Drawing no: GBR_EPD_CTV) for further details. CCTV is also proposed around the BESS compound (as detailed in paragraph 2.44 above).

Facilities

2.53 A composting toilet will be based on-site for use by staff during operational and maintenance works. It can also be made available for use by visitors as necessary.

2.54 The composting toilet is liklely to comprise a 'WooWoo Waterless Toilet'. The composting toilet will separate the urine and sanitary waste from the solids and will be inspected on maintenance visits to the site during the operation of the Proposed Development. It is anticipated that this will be 2.4m (L) x 2.5 (W) x 3.0 (H).

2.55 Refer to **Figure 2.28**. – Composting Toilet (Drawing no: GBR_EPD_TLT) for further details.

Cabling

2.56 All of the cabling within the northern and southern parcels of the site will be laid underground via surface dug trenches of up to approximately 1m deep and 50cm wide and backfilled. These will

utilise existing access tracks and road options wherever practicable, particularly where sensitive habitats or archaeology are potentially present.

2.57 A cable route between the northern and southern parcels will be installed using Horizontal Directional Drilling (HDD) under the road and trees into the site and via an existing Public Right of Way (PRoW) to reduce disruption to the road and any impact on the woodland as far as practicable.

2.58 The 33kV cable route from the substations to the south of the site, will connect to the existing Legacy Substation to the south-west of the site, passing to the east of Bersham Ironworks Museum, under the River Clywedog and Clywedog Trail via trenching or HDD. Where the route passes through fields for example, the cables will be trenched, but HDD will be used where necessary to minimise impact including under the River Clywedog, or under Offa's Dyke (Option 1).

2.59 As presented within **Figures 2.2a** and **2.2b** the 'preferred cable route option' is shown as well as three short alternative cable route options. All options will route south of the site before joining the Plas Buckley Road. All options would follow the existing unnamed road west to the north of Cadwgyn Hall, before connecting to Legacy Substation. Cable Route Option 1 would pass to the south of Cadwgyn Hall through agricultural fields, before connecting to Legacy Substation. Cable Route Option 1 would cross Footpath ESC/1. Should this cable route be pursued, the PRoW may need to be temporarily closed for the duration of the works.

2.60 The Preferred cable route would however route along the road past Cadwgyn Hall, the excavation of the trench to install the cable would be limited to the extent of the road to avoid impacting on Offa's Dyke. In addition, precautionary working methods will be applied and detailed in the outline Construction Environmental Management Plan (CEMP) to prevent adverse impacts to the River Clywedog which runs just north of the unnamed road in this location. Alternatively at this location, Cable Route Option 1 would be installed by HDD under Offa's Dyke to reduce impact as far as practicable. Cable Route Option 2 and Cable Route Option 3 provide a short alternative route to connect from Plas Buckley Road to the south of the site.

2.61 All cable route options will likely require the temporary management, diversion or closure of Footpath 'ESCLUSHAM/ABOVE/3' adjacent to the west of the legacy substation during the construction and laying down of the cable route, this would be for a temporary period and then re-instated following the cable route construction. Any PRoW diversions or closures required as a result of the construction of the Proposed Development will be subject to the necessary consents.

2.62 In terms of the assessment of the cable route options in this ES, each option has been assessed individually so that upon confirmation of the final cable route, an assessment of any effect associated with that route has been considered.

2.63 Where practicable the cable routes will be installed within the fields adjacent to the roads to reduce disruption to the road as far as practicable. These will be laid underground via surface dug trenches of up to approximately 1m deep and up to approximately 1m wide and backfilled.

2.64 There may be the need to remove some of the trees to the south of the site, adjacent to the A483, where the cable routes out of the site and if HDD is not practical. The potential requirement for tree removal is assessed in the Arboricultural Impact Assessment (AIA) (Appendix 5.8).

2.65 These cable route options are indicated on **Figures 2.2a** and **2.2b**. Where the cable installation method is currently unknown, the assessment undertaken in this ES has assumed the worst-case scenario of open trenching.

Access and Parking

2.66 The main strategic routes to the area near the site are:

- A483 towards Chester in the north and Oswestry and the A5 to the south. These routes provide links to larger cities such as Cardiff and Swansea to the south and Liverpool and Manchester to the North.
- A534 towards Nantwich, linking to the A500 towards Stoke-on-Trent and the M6. This route links to Birmingham, Bristol, Derby and Nottingham.
- Junction 4 of the A483 provides access on to the A525 with access to both the southern and northern parcels of land being taken from the A525.

2.67 Several access points will be used for access for the construction, operation and maintenance and decommissioning of the Proposed Development. If necessary, some minor modifications will be required for temporary accesses to be created from the highway to enable access to the site for construction.

2.68 A new access (Access 1) will be constructed to the east along the A525 west of Heritage Way, which will serve as the main construction access point for the southern parcel of the site and will subsequently also be used as the main access for operation and maintenance site visits. **Figure 2.29** - Existing Southern Site Access (Drawing ref: 330610724-SK-1200-004) provides details the existing arrangements for the southern access, and **Figure 2.30** – Indicative Southern Site Access provides details on the proposed southern site access. (Drawing ref: 330610724-SK-1200-001). Whilst Access 1 is being constructed, there will be a short-term temporary requirement to use Access 3 to access the site during construction set up and establishment. The existing Home Farm access (Access 3) will be used for maintenance access when the Proposed Development is operational if required.

2.69 Access 1 will need to provide sufficient width to allow a large articulated vehicle to enter and exit the site safely. Up to approximately 25m of the existing wall and two trees will also need to be removed, and the existing road sign will need to be relocated (**Figure 2.31** – Indicative Southern Site Access Cross Section (Drawing ref: 330610724-SK-1200-005) provides an illustrative cross-sectional illustration of this access). It is proposed to retain the stonework from the affected section of wall and use it to create an entrance way to the site with the wall curving round with the radii of the entrance junction. This access would have the advantage that it would avoid properties situated around the Home Farm access and would minimise the distance between the A483 strategic route and the southern area of the site.

2.70 Abnormal indivisible loads (AILs) (if required) would be able to access the site via Access 1 using the identified strategic routes, which are suitable for use by AILs. Should an AIL be needed a suitably qualified haulier would confirm the route from point of origin using the required notification process.

2.71 It is not proposed to use the access to the southern part of the site from the south along Rhos Berse Road (Access 4) during construction, operation or decommissioning, but may be needed in exceptional circumstances and will be limited to staff or emergency vehicular access only, and would be limited to cars and LGVs.

2.72 The access to the northern parcel of the site (Access 2) will be via an existing farm access routing north off the A525. The existing access is currently used by large agricultural vehicles and would be suitable for Heavy Goods Vehicles (HGVs) with some improvements (**Figure 2.32**). – Indicative Northern Site Construction Access (Drawing no: 330610724-SK-1200-003)). It will require advance signage to warn of the site access and construction vehicle movements and potential speed reduction via traffic management. Through detailed design and the road safety audit process the

access safety will be examined, but at this stage the access is considered a safe and viable HGV access point with appropriate traffic management. This access point could be reconfigured in a number of ways and designed to accommodate the required movements, although as it is the sole point of access for adjacent dwellings, reconfiguration would require maintaining the access for residents.

2.73 There will be no access to the northern part of the site from Tan Llan Lane to the north.

2.74 Existing farm tracks will be used for internal access within the site wherever practicable. New access tracks, where required, will be formed, normally using a layer of permeable crushed stone (**Figure 2.33**. Indicative Road Cross Section (Drawing ref: GBR_EPD_RCS)). Geosynthetic reinforcement or soil stabilisation may be used to reduce the depth of track construction. The surface will be a compacted granular material (crushed rock) up to an approximate thickness of 0.3m, dependent on the ground conditions. Width will increase at bends and at the entrance point. The tracks will measure between 3.5m and 4.5m wide.

2.75 An outline Construction Traffic Management Plan (oCTMP) has been produced which sets out the measures to manage construction traffic to reduce impacts on the roads as far as practicable. The oCTMP is included at **Appendix 2.3.** Prior to construction, a detailed CTMP will be produced to provide further detail in respect of construction traffic management measures. The detailed CTMP will be prepared in general accordance with the oCTMP.

Surface Water Drainage

2.76 A Flood Consequences Assessment and Conceptual Drainage Strategy has been produced and is included at **Appendix 8.1**. Details of surface water management are contained within the Flood Consequences Assessment (FCA) and summarised below.

2.77 The Proposed Development is expected to increase permanent impermeable areas within the site by 0.03% of the total site area. A SuDS strategy has been produced to incorporate appropriate management techniques that will mitigate potential increase in runoff from the Proposed Development (see **Appendix 8.1**).

2.78 SuDS techniques include filter strips, swales and attenuation for ancillary features is proposed via gravel basis in which infrastructure will be located upon. Access tracks will be constructed out of permeable materials.

2.79 Solar PV arrays are designed in such a way to prevent surface water sheeting off panels and potentially causing erosion. Panels are designed to allow surface water to drip off, landing onto filter strips below.

2.80 All ancillary features will be placed on a gravel or concrete subbase sized to accommodate the 100 year + 20% climate change critical storm event. The detailed design stage will confirm exact construction methodology.

2.81 The detailed operational drainage design will be developed pre-construction with the objective of achieving drainage of the land to the present level.

Public Rights of Way

2.82 PRoW BER/1 (Bersham Public Footpath 1) runs through the southern parcel of the site and PRoW/8 (Bersham Public Footpath 8) also runs through the northern parcel of the site. This PRoW network runs north/north-west through the southern area of the site before meeting the A525. It continues approximately 650m to the west along the A525 where it runs north through the northern parcel of land. There will be no extinguishment of this PRoW as a result of the Proposed Development,

however some minor re-alignment will be required which is subject to the application for a PRoW Diversion Order which is included as an application for a secondary consent to this DNS application.

2.83 Currently the WCBC Definitive PRoW Map shows the alignment of PRoW BER/1 and PRoW BER/8 in a different position to the paths which are walked on the ground. The proposed re-alignment will therefore realign the Definitive Map along a more accessible route (i.e. one which isn't on a steep incline or intercepted by hedgerows), including part which is the walked route on the ground. The alignment of the PRoW is indicated on **Figures 2.2a** and **2.2b** – Indicative Site Layout Plans.

2.84 Where appropriate, hedgerow enhancements will be incorporated along the PRoW to screen views of the Proposed Development and a width of 5m will be incorporated for all PRoWs to be retained throughout the site. Further detail in respect of the proposed PRoW treatment is included in the Illustrative Landscape and Ecology Masterplan which is included at **Figure 5.10**.

Appearance and Design

2.85 The Proposed Development is low-lying in nature, and the infrastructure is typically shorter in height than the many existing mature trees and hedgerows around the site.

2.86 The appearance will be a more modern and obvious human influence on the landscape compared to that currently formed by agriculture. While construction will cover a wide area, the works would be temporary and the Proposed Development itself will be considerably less solid and durable in appearance than traditional buildings. This would mitigate against the likely change in the character of the landscape.

2.87 The Proposed Development would be removed at the end of its 40 years lifetime enabling the site to return to its former agriculture character and appearance.

Landscape Strategy

2.88 Landscape mitigation is embedded in the overall design and has been formulated to reduce potential landscape and visual impacts as far as practicable and maximise enhancement of landscape features, landscape character and biodiversity of the site.

2.89 An Illustrative Landscape and Ecology Masterplan has been produced and is included at **Figure 5.10**. A Typical Planting Palette is also included within the Landscape and Ecology Management Plan (LEMP) (**Appendix 6.8**). The landscape proposals include the following measures:

- internal and boundary hedgerow reinforcement appropriate to the arable and pastural fields that would improve the site's existing field structure, enhancing biodiversity and habitats for local wildlife and provide additional screening of the site and solar PVs within views.
- woodland edge scrub planting is proposed adjacent to existing areas of established woodland to improve connectivity and intergration within the site.
- structural woodland planting is proposed for the landscape treatment, where space allows and to help screen views of the solar PVs and enhance the wooded character within the site.
- various meadow grassland mixes are proposed for diffrent habitat creation that include a tussocky grassland for grazing beneath the solar PVs, woodland meadow for the connectivity of areas adjacent to existing woodland, wetland meadow of wet areas and a wildflower meadow.

- a landscaped 'area in the northern parcel would be accessible to the existing PRoW network. Information boards are also considered to assist with raising awareness of the sites history, local biodiversity enhancements and educating about solar energy.

- Ecological Enhancement Areas – Biodiversity Area 1 (undisturved) and Landscape and Biodiversity Area 2 (open space and amenity) comprising land within the red line boundary containing no infrastructure. Further detail specified in **Figure 5.10**.

2.90 Landscape and biodiversity are considered in more detail in Chapter 5: Landscape and Visual Impact Assessment and Chapter 6: Biodiversity of this ES respectively.

Lighting

2.91 Some temporary task lighting may be required during construction depending on the time of year and sunlight levels.

2.92 The BESS compound includes lighting columns adjacent to each BESS enclosure as shown on **Figure 2.14** – Indicative BESS Layout (Drawing no: BESS_LYT). Each lighting column will be designed as shown on **Figure 2.24** – BESS Lighting Pole (Drawing Number: GBR_EPD_BLG). The lighting in the BESS compound will only be used in the event of an emergency taking place during the dark and will not be used as part of the regular operation of the site.

2.93 Given that the use of artificial lighting during both construction and operation would be temporary – as required or in the case of an emergency – there will be no likely significant impact on visual receptors and no likely significant effect on field boundary habitats and/or adjoining woodland.

2.94 The Proposed Development will cause a minimal amount of potential for redirection of light in terms of glint and glare via the surface of the panels. Any effects in terms of glint and glare would be localised and unlikely to be of a magnitude that would be significant in environmental terms. As such, consideration of these effects has been scoped out of the ES as a specific chapter.

2.95 This approach was confirmed as acceptable in the Scoping Direction(s) (**Appendix 4.2** and **Appendix 4.4**) which state that PEDW is supportive of the inclusion of a Glint and Glare Assessment which is contained within **Appendix 5.1** of Chapter 5: Landscape and Visual Impact Assessment.

Sustainability

2.96 This section outlines the effects of the Proposed Development on sustainability factors such as energy demand, waste, use of natural resources and residues and emissions.

Energy Demand

2.97 The Proposed Development will supply electrical energy to the distribution network rather than generate demand.

2.98 The Welsh Government (WG) has formally committed Wales to legally binding targets to deliver the goal of net-zero emissions, with the Climate Change Committee recommending the following targets that the Proposed Development will contribute to:

- Carbon Budget 2 (2021-25): 37% average reduction with credit ("offset") limit of 0%
- Carbon Budget 3 (2026-30): 58% average reduction
- 2030 target: 63% reduction
- 2040 target: 89% reduction

- 2050 target: 100% reduction (net zero).

2.99 The Proposed Development will also contribute to cost-effective energy generation and energy security with limited governmental subsidy and will, therefore, provide socio-economic and community benefits. Notably, the design of the Proposed Development will allow an efficient dual use of the land for renewable energy generation and agriculture.

Waste

2.100 Waste produced during construction will be kept to a minimum and will be managed and sorted accordingly. Only registered waste management companies will be utilised to dispose of construction waste (packaging, wood, metal) or waste from the construction team (general domestic or canteen/kitchen waste). The specialist engineering, procurement and construction (EPC) contractor hired to construct the Proposed Development will ensure that all waste is disposed of responsibly using only licensed waste management companies. This will be subject to appropriate due diligence checks prior to contracting.

2.101 Following decommissioning there will be significant potential for recycling many of the materials used in the Proposed Development Solar panels are almost entirely made up of glass, aluminium, and silicon which can all be separated and recycled. Since January 2014, solar panels in the UK have been covered by The Waste Electrical and Electronic Equipment Regulations 2013 (as amended), which require recycling of the panels at the end of their operational life. The Applicant is a member of the PV Cycle UK take back scheme for this purpose.

Use of Natural Resources

2.102 The Proposed Development is temporary in nature and fully reversable. Appropriate construction techniques will be implemented to reduce above and below ground works and to reduce any compaction of soil as far as practicable, mitigating any potential impact on the soil structure and ability to infiltrate water. Most of the soil will not be physically impacted by the Proposed Development. This is further outlined in the outline Soil Resource Management Plan (oSRMP) (**Appendix 10.1**).

2.103 Localised areas of earthworks will be required to create level platforms for the BESS, substations, transformers and other containerised infrastructure, and to create the trenches for the cables. Topsoil will be removed from the relevant areas and set aside separately from any subsoil. When backfilling the cable trenches, the subsoil will be replaced first, followed by the topsoil. Soils will be managed in accordance with the Outline Soils Resource Management Plan.

2.104 Following decommissioning, the approach taken to construction allows the future quality of the agricultural land to be maintained with no likely significant lasting adverse effects on the quality of the soil.

2.105 A desktop Agricultural Land Classification (ALC) Survey Report of the site was completed by AMET in November 2022. The ALC Survey Report is included at **Appendix 10.2** of this ES.

2.106 ALC guidelines (MAFF 1988) categorises agricultural land into the following grades:

- grade 1: excellent quality agricultural land
- grade 2: good quality agricultural land
- grade 3a: good to moderate quality agricultural land
- grade 3b: moderate quality agricultural land

- grade 4: poor quality agricultural land
- grade 5: very poor quality agricultural land

2.107 Planning Policy Wales (PPW) 12 defines grades 1 to 3a as the 'best and most versatile' (BMV) agricultural land.

2.108 The ALC Survey Report confirms that the areas surveyed are variously limited by both wetness and droughtiness and that only 6.4% of the survey area (1.6 ha) contains Grade 3a BMV agricultural land. The wider survey area contains 83.7% (21.5 ha) Grade 3b and 7.9% (2 ha) Grade 4 agricultural land.

2.109 The ALC Survey Report has been independently verified by the WG Land Quality Advice Service (LQAS). In respect of the 1.6 ha of Grade 3a agricultural land which is contained within the site, LQAS confirmed that it does not consider the loss of 1.6 ha of BMV land to be *'a matter in the national agricultural interest'* and that it would be a matter for the Determining Authority to take a view regarding compliance with PPW 3.58 and 3.59 in the light of evidence before them. However, this area of Grade 3a agricultural land to the north of the northern parcel, has subsequently been removed from the site.

2.110 The 2023 Scoping Direction addendum confirmed that in respect of land and soil:

"LQAS welcomes that the red-line boundary has been amended to avoid Best and Most Versatile (BMV) agricultural land. The Applicant's attention is drawn to comments from LQAS highlighting the Environmental Statement should address the methodology for the installation and decommissioning of the infrastructure, including how likely impacts have been assessed or will be avoided. The Applicant's attention is also drawn to LQAS' comments in relation to the requirements for a soil management scheme, which should be prepared as part of the Construction Environmental Management Plan. The draft CEMP should be provided as a technical appendix to the ES. Based on comments from the Welsh Government's LQAS, ***Soil is hereby scoped into the ES.****"*

2.111 As such, Chapter 10: Soil provides an assessment of the effect of the Proposed Development on soil.

Residues and Emissions

2.112 Details of any likely significant effects in relation to residues and emissions having regard to water are set out in Chapter 8: Hydrology and Hydrogeology of this ES.

2.113 Regarding emissions, Chapter 9: Climate Change of this ES provides an assessment of the likely significant effects of the Proposed Development having regard to climate change.

2.114 As explained in Chapter 9: Climate Change, this will be achieved through the Proposed Development's operation displacing carbon intensive forms of electricity generation outweighing the effect of emissions associated with the Proposed Development's construction. This results in the Proposed Development contributing positively to WG targets for the reduction of greenhouse gas emissions.

2.115 Other environmental aspects relevant to residue and emissions, air quality and human health, have been scoped out of the ES, agreed by PEDW.

2.116 Due to the nature of the development, once operational there would be no emissions generated by the development. The proposal will have no direct adverse environmental effect on air quality and therefore will have no significant environmental effect in EIA terms. More widely, the electricity the proposed development will produce will potentially displace primary fossil fuel derived electricity that

relies on thermal combustion and the consequent release of Green House Gases (GHGs) and other pollutants into the atmosphere consequently, the proposal is considered to have a beneficial effect on air quality.

2.117 The direct human health effects of the proposed development are limited, as the proposed development will displace primary fossil fuel derived electricity and the consequent Greenhouse Gases and other pollutants released during fossil fuel combustion and would result in a beneficial effect on human health.

Vulnerability to Accidents and Disasters

2.118 The EIA Regulations state that an EIA must identify, describe and assess, in an appropriate manner, the direct and indirect likely significant effects arising from the vulnerability of the Proposed Development to risks of major accidents or disasters. Vulnerability of the Proposed Development to major accidents introduced by the location should be considered as well as risks that are an inherent characteristic of the Proposed Development.

2.119 The objective of such an assessment is to establish whether the Proposed Development increases risks to existing receptors or increases the sensitivity of those receptors to the consequences of the hazard. For example, by introducing new links/pathways between a possible hazard and a receptor.

2.120 Solar photovoltaic technology is a relatively benign and safe form of electricity generation with very low risk of accident or disaster and will not have a significant environmental effect in this regard.

2.121 The Proposed Development will be enclosed by appropriately designed security fencing and monitored by CCTV, which will lower the risk of unauthorised access and accidents.

2.122 An outline Battery Safety Management Plan (oBSMP) has been produced and is included at **Appendix 2.1** of this ES. The BSMP provides a preliminary safety hazard identification and analysis, based on like for like energy storage systems of this type, namely Lithium-Ion Battery technology, and determines the likely causes and hazards associated with BESS technology of this type to enable the initial identification of potential control measures that when implemented will ameliorate the level of risk posed to an acceptable level. In summary the Outline BSMP concludes that as far as reasonably practicable at this stage, that currently foreseeable hazards associated with the equipment have been identified and can be actively managed throughout the life of the proposed development. Accordingly, vulnerability to accidents and disasters is scoped out of this ES, as confirmed by PEDW in the Scoping Direction.

Summary of Key Parameters

2.123 The table below provides a summary of the key parameters which have formed the basis for the assessment of effects.

Table 2.2: Key Parameters for Environmental Assessment

Element of the Development	Key Approximate Maximum Parameter for EIA
Site area	Approximately 136 hectares.
Maximum height	Solar panels, inverters and transformers up to 3.2 m above ground. Substations up to 3.5 m above ground. Monitoring House up to 3.3 m above ground. Storage container up to 2.6 m above ground. Battery Storage Units up to 2.6 m above ground.

Element of the Development	Key Approximate Maximum Parameter for EIA
Area of built development comprising:	
Area covered by solar panels	Approximately 136ha hectares. The panels will be positioned at an angle of between 15-25 degrees, with a proposed height of up to 3.055m to the top of the panel frame on level ground, including 1m of ground clearance to enable maintenance access below the PV modules. Where there the ground undulates there may be minor variability to the maximum height up to 3.20m. Please refer to **Figures 2.2a** and **2.2b**
Inverters in containerised units	Containerised units are anticipated to be 2.3 m wide, 8.2 m long and 2.8 m high. It is anticipated that there will be 26 inverters and each is anticipated to be 8.2m (L) x 2.3m (W) x 2.8m (H) (including the base). Please refer to **Figure 2.5**.
Transformers	It is anticipated that there will be 26 transformers. It is anticipated that each will be 5.5m (L) x 4.5m (W) x 3.2m (H). Please refer to **Figure 2.6**.
Switchgear substations	It is anticipated that there will be 14 switchgear substations. It is anticipated that each will be 4.2m (L) x 2.6m (W) x 3.15m (H) (including the base). Please refer to **Figure 2.7**.
Auxiliary transformer	It is anticipated that there will be 1 auxiliary transformer. This is anticipated to be 3.8m (L) x 3.8m (W) x 3.2m (H). Please refer to **Figure 2.8**.
PV Intake Substation	It is anticipated that there will be 1 PV intake substation. This is anticipated to be up to approximately 10.5m (L) x 2.5m (W) 3.1m (H) (including the base) Please refer to **Figure 2.9**.
Customer Substation	It is anticipated that there will be 1 customer substation. This is anticipated to be approximately 10.3m (L) x 5.0m (W) 3.9m (H) (including the base). Please refer to **Figure 2.10**.
GRP Substation	It is anticipated that there will be 1 GRP Substation. This is anticipated to be approximately 3.0m (L) x 3.0m (W) x 2.55m (H). Please refer to **Figure 2.11**.
Monitoring House/Communications Building	It is anticipated that there will be 2 monitoring houses / communications buildings. Both monitoring houses are anticipated to be the same design and size, which will be 3.9m (L) x 3.2m (W) x 3.3m (H) (including the base). Please refer to **Figure 2.12**.
Spares container	It is anticipated that there will be 1 storage container. This is anticipated to be 12.4m (L) x 2.6m (W) x 2.9m (H). Please refer to **Figure 2.13.**
Security fencing and gates	Fencing of approx. 2m height surrounding the site. Gates approx. 2.0m (H) and 5.0m (W). Please refer to **Figure 2.25 – Figure 2.26**.
Solar CCTV	Numerous CCTV cameras mounted on poles 2.5-3.5m high. Please refer to **Figure 2.27**.
Composting Toilet	It is anticipated that this will be 2.4m (L) x 2.5 (W) x 3.0 (H).

Element of the Development	Key Approximate Maximum Parameter for EIA
	Please refer to **Figure 2.28**.
Up to 28 Emergency Lighting Posts	3.86m (H)
Internal access roads	Internal road network to allow access on site approx. 3.5m – 4.5m wide.
Existing Southern Site Access	50m at widest point. Please refer to **Figure 2.29.**
Indicative Southern Site Access	30m at widest point. New permanent private access to Proposed Development site with 2.4m setback for visibility splay. Please refer to **Figure 2.30**.
Indicative Southern Site Access Cross Section	Please refer to **Figure 2.31**.
Indicative Northern Site Construction Access	25m at widest point with 2m visibility setback. Please refer to **Figure 2.32**.
Indicative Road Cross Section	Please refer to **Figure 2.33**.
Indicative BESS Layout	Please refer to **Figure 2.14**.
BESS Enclosures	It is anticipated that there will be 14 groups of 4, Bess enclosures. Each group of 4 enclosures is anticipated to be 16.62m (L) x 3.88m (W) x 3.0m (H). Please refer to **Figure 2.15**.
BESS - BIC	It is anticipated that there will be 14 Battery Interface Cabinets (BICs). The BICs facilitates the battery enclosures to electrically interface with the electrical network on site. Each BIC is anticipated to be 2.2m (L) x 1.1m (w) x 2.3m (H). Please refer to **Figure 2.16**.
BESS - Twin MV Skid	It is anticipated there will be 7 Twin MV Skids. Each Twin MV Skid is anticipated to be 13.37 (L) x 6.9m (W) x 3.96 (H). Please refer to **Figure 2.17**.
BESS Backup Generator	It is anticipated there will be 1 BESS Backup Generator. This is anticipated to be 6.3m (L) x 2.64m (W) x 2.89m (H). Please refer to **Figure 2.18**.
BESS Spares Container 20ft	It is anticipated there will be 1 BESS Spares Container. This is anticipated to be 6.3m (L) x 2.64m (W) x 2.9m (H). Please refer to **Figure 2.19**.
BESS Intake Substation	It is anticipated there will be 1 BESS Intake Substation. This is anticipated to be 15.70m (L) x 3.00m (W) x 3.60m (H). Please refer to **Figure 2.20**.
BESS Monitoring House	It is anticipated there will be 1 BESS Monitoring House. This is anticipated to be 3.86m (L) x 3.2m (W) x 3.3m (H). Please refer to **Figure 2.12**
BESS Security Fencing	The BESS security fencing is typically welded mesh up to approximately 2.5m high. Please refer to **Figure 2.21**.
BESS CCTV	It is anticipated there will be up to 7 CCTV posts surrounding the BESS. The BESS CCTV will be circa 3.5m high on galvanised steel posts. Please refer to **Figure 2.22**.
BESS Gate	The BESS gate will be up to approximately 2.5m high. Please refer to **Figure 2.23**.
BESS Lighting Pole	There will be 28 individual lighting columns each with a height of 3.86m. Please refer to **Figure 2.24**.

Element of the Development	Key Approximate Maximum Parameter for EIA
Areas of landscaping/semi-natural greenspace	Native hedgerow and tree planting provided to improve screening of the Proposed Development were possible. 2 landscape and ecology mitigation areas of approx. 3 ha. Please refer to **Figure 5.10**.
Cabling	Preferred cable route option and 3 additional proposed cable route options routing south of the site and connecting to existing National Grid Substation.The max depth of cable trenching is anticipated to be 1m deep and up to approximately 1m wide and backfilled (or HDD as necessary).
Drainage	Temporary construction drainage systems and conceptual surface water drainage strategy comprising permeable surfacing and swales.

Construction

2.124 The details of construction methods, timing and phasing are necessarily broad at this stage. The limits of the assessment, however, have been set sufficiently wide to allow a robust assessment to be undertaken of a reasonable worst-case scenario.

2.125 An outline Construction Environmental Management Plan (oCEMP) is contained within **Appendix 2.2** and an oCTMP is contained within **Appendix 2.3** of this ES. The Proposed Development is anticipated to utilise established standard construction methodologies (including piling) for solar farms.

Indicative Phasing of Construction Works

2.126 The timing of the construction of the Proposed Development would be dependent on securing planning permission and the discharge of planning conditions. The indicative construction programme for the solar element sets out a programme of approximately 12-18 months duration.

2.127 It is assumed that the construction of the Proposed Development (excluding the BESS element which will be constructed at a later date) is likely to be phased as shown in **Table 2.3** below.

Table 2.3: Indicative Phasing of Construction

Phase	Indicative Dates	Activities
1	Q1 2025	Site preparation (incl. accesses, construction compound, fencing).
2	Q1-Q3 2025	Delivery of construction materials
3	Q2 2025-Q1 2026	Construction and installation of the solar arrays, and associated infrastructure.
4	Q1-Q2 2026	Demobilisation and equipment removal.
5	Q1-Q4 2026	Landscaping including biodiversity enhancements.
6	Q1 2026	Connection.

2.128 The broad sequence of construction activities is likely to be:

- Site entrance creation and enabling works;
- Erection of security fencing and gates;
- Laying down of temporary construction compounds;

- Installation of the temporary compounds;
- Construction of access tracks through the site;
- Delivery of solar, PV and associated equipment;
- Installation of foundations for structures such as inverters, transformers, and substations;
- Piling and installation of mounting frames, solar panels and solar farm infrastructure;
- Cable trenching, ducting and backfilling;
- Installation of inverters, transformers, and substations;
- Laying of underground cable from the solar farm to the existing Legacy Substation;
- Commissioning of the solar farm and grid connection;
- Landscaping and ecological enhancements works; and
- Demobilisation from the site, including removal of the temporary construction compound.

2.129 Construction of the BESS will take approximately 6-9 months (independent of the overall construction programme). The BESS element of the Proposed Development will be constructed at a later date and is currently expected to be constructed during 2032 and will be completed by 2033 at the latest. Construction of the BESS will consist of the following principal activities:

- Delivery of the BESS and associated equipment;
- Installation of foundations for structures;
- Cable trenching, ducting and backfilling;
- Installation of BESS containers and associated infrastructure;
- Commissioning of the BESS connection.

2.130 The site would be fenced during construction. It is the intention of the Applicant that the site would be registered under the Considerate Constructors Scheme (CCS) or a similar locally recognised certification scheme.

Construction Working Hours

2.131 Construction working hours will be 07:00 to 19:00 hours Monday to Friday, 07:00 to 13:00 hours on Saturday and at no time on Sundays or on public or bank holidays. However, noisy activities such as piling will be undertaken 08:00 to 18:00 hours Monday to Friday and 08:00 to 13:00 hours on Saturday. In the event that works are required outside of these hours in exceptional circumstances, this would be agreed with the WCBC prior to commencement of the activity, as necessary.

Construction Staff

2.132 There will be approximately 100 construction workers during construction for the solar farm, but it is expected there will be a maximum of 75 staff on site at any one time. The number of staff for construction of the BESS will be less. The number of staff on site will vary subject to the overall programme of works and the type of works being undertaken.

Environmental Management during Construction

2.133 An oCEMP and an oCTMP (provided at **Appendix 2.2** and **Appendix 2.3** of this ES) provide the framework and requirements for managing the construction activities and movement of traffic to and from the site in order to reduce the impact on the environment and local road network as far as practicable during the construction period of the Proposed Development.

2.134 The oCEMP sets out the key management measures that contractors would be required to adopt and implement. These measures have been developed based on those identified during the EIA process and set out in the topic chapters of this ES. They include strategies and control measures for managing the potential environmental effects of construction and limiting disturbance from construction activities as far as reasonably practicable. The oCEMP will set out measures to control impacts in relation to the following:

- Traffic
- Noise
- Materials and Waste
- Biodiversity
- Hydrology
- Dust
- Storage
- Safety and Security

2.135 For Materials and Soils Management, the oCEMP will provide detail on the soil stripping programme - volumes and types of soils affected; soil handling techniques and procedure; size, location, construction, management, and period of soil storage.

2.136 This oCEMP would form the basis of more detailed plans and method statements, included in a detailed CEMP to be prepared during the pre-construction period once a Principal Contractor has been appointed. The final detailed CEMP would be prepared and submitted to WCBC.

2.137 Additionally, the oSRMP (**Appendix 10.1**) outlines how access will be managed to minimise impacts on soils; how soil damage will be minimised and ameliorated during works; and a methodology for monitoring soil condition, and criteria against which compliance will be assessed.

Construction Working Areas

2.138 Temporary construction compounds will be required in the southern and northern parcels. The main construction compound will be located in the southern area and will be accessed by construction vehicles via Access 2. Smaller satellite compounds, including one for the BESS, will be required across the northern and southern areas to facilitate access in those areas.

2.139 The temporary construction compounds will house temporary site office space and welfare facilities, an unloading area, and short-term parking for HGVs, temporary storage areas, waste storage and parking for the construction staff. These will be constructed using a hardcore or geogrid base, or similar, and will be removed when the construction phase is complete.

2.140 As far as practicable, construction compounds (including storage areas) would be located away from existing properties to reduce impacts as far as practicable. Such storage areas would also be bunded to mitigate any spillages of potential contaminants and would avoid being located in areas of vegetation or habitat to be retained.

Construction Access

2.141 The main construction access will be off the A525 via Access 1. It would provide a route emerging some 75-100m west of the Heritage Way and A525 Junction. It is proposed that this access is initially created to provide access for the construction phase and then retained as a permanent access for maintenance. Concept design work to create a priority junction has been undertaken. To provide sufficient width to allow a large articulated vehicle to enter and exit the site safely it is estimated that some 25m of the existing wall will need to be removed. Two trees will also need to be removed and the existing road sign will need to be relocated. It is proposed to retain the stonework from the affected section of wall and use it to create an entrance way to the site with the wall curving round with the radii of the entrance junction.

2.142 Existing farm tracks will be used for internal access within the site wherever practicable. New access tracks, where required, will be formed, normally using a layer of permeable crushed stone. Geosynthetic reinforcement or soil stabilisation may be used to reduce the depth of track construction. The surface will be a compacted granular material (crushed rock) up to an approximate thickness of 0.3m, dependent on the ground conditions. Width will increase at bends and at the entrance point. The tracks will measure between 3.5m and 4.5m wide.

2.143 Effects arising from traffic associated with the construction phase of the Proposed Development will be reduced as far as practicable. Materials and resources would be sourced locally where practicable, and deliveries and construction traffic will endeavour to avoid travel during commuter peaks.

2.144 Detail of the delivery routes, construction routes, construction compounds and any associated parking or management of construction traffic is set out in the oCTMP (**Appendix 2.3**).

Construction Vehicles

2.145 The type of construction vehicles would be selected by the contractor prior to and during the construction phase. However, the following vehicles would typically be used during construction:

- Excavators;
- Cranes: Required for assembly and erection;
- Low loaders: Required for transport of construction equipment and plant;
- Concrete lorries;
- Tipper lorries; and
- Construction staff vehicles.

2.146 Typical site working hours will be 0700-1900 Monday to Friday and 0700-1300 Saturday. There will be approximately 1,200 HGV movements across the course of the solar construction programme (and less for the BESS). Based on an 18-month construction programme (maximum scenario) and 5.5 day working week this would equate to around 4-5 HGVs (8-10 movements) per day. However, it is recognised that a flat profile across the programme is unlikely and there will be peaks in activity associated with overlaps in the construction programme and more transport intensive activities taking place. In order to reduce disruption to the road network as a result of the construction of the Proposed Development as far as practicable, the oCTMP sets out management measures, including the following:

- Safety and environmental standards and programmes – industry practice will be adopted to support the works at the development. This will be achieved through the procurement process whereby the sub-contractors and supply chain will be preferred if they are members of or signed up to relevant industry practice schemes and initiatives including, for example,

Considerate Constructors Scheme, Fleet Operator Recognition Scheme or Construction Logistics and Community Safety.

- Adherence to designated routes – the oCTMP sets out designated routes to site which have been reviewed with respect to reducing potential impacts as far as practicable, conflicts and hazards. A copy of the route plan will be given to all suppliers when orders are placed so that drivers are fully briefed on the required route to take. The supplier will be made aware that these routes are always required to be followed unless otherwise agreed or diversions are in place.

- Delivery scheduling – delivery scheduling for road movements would be confirmed with the Principal Contractor's logistics team. An electronic Delivery Management System will be implemented to book and manage vehicles visiting the site.

- Re-timing for out of peak deliveries – The arrival/departure of HGVs to/from the site during the morning peak (i.e. outside 07:00-09:00hrs) will be reduced where practicable. Suppliers and hauliers will be made aware of this commitment and monitoring will be undertaken through the Delivery Management System.

2.147 Although it is not expected that the Proposed Development would generate any abnormal loads, if this was required, the routing and nature of such loads would be agreed with the highway authority prior to work commencing.

Construction Plant and Equipment

2.148 As outlined in **Table 2.4**, plant and equipment required for the construction phase may include but not be limited to the following:

Table 2.4: Construction Plant and Equipment

Equipment	Function
Dump trucks	Earth distribution as required for any levelling
Vibrating roller	Compacting tracks
Piling machine(s)	Ramming piles of mounting frames / fencing posts into the ground
Telehandler(s)	Distributing materials
Crane	Capable of lifting inverters, transformers, battery containers, etc into place
Fuel bowser	Refuel plant as required
Concrete mixer	Foundations for inverters, transformers, battery containers, etc.
JCB Diggers / cable trenching machines	Trenching for cables

Public Rights of Way

2.149 The existing PRoW which currently runs through the northern and southern parts of the site – the Bersham Public Footpath 1, will be retained. However, during construction there may be a requirement to temporarily close or divert the PRoW to ensure public safety, for example if the tracks, or parts of the tracks need to be used heavily for a period of time by construction vehicles.

2.150 Cable Route Option 1, if adopted would cross Footpath ESC/1 and therefore the PRoW may need to be temporarily closed for the duration of the works in this location.

2.151 Whichever cable route option is selected, connection into to west of the legacy substation will likely require the temporary diversion or temporary closure of Footpath 'ESCLUSHAM/ABOVE/3' during the construction and laying down of the cable route, this would be for a temporary period and then re-instated following the cable route construction.

Drainage

2.152 The construction phase would incorporate pollution prevention and flood response measures so that the potential for any temporary effects on water quality or flood risk are reduced as far as practicable.

2.153 Such measures would be implemented through the detailed CEMP, which will require the following:

- Management of construction works to comply with the necessary standards and consent conditions as identified by Natural Resources Wales (NRW) and Wrexham Borough County Council.
- A briefing for all staff highlighting the importance of water quality, the location of watercourses and pollution prevention included within the Project site induction.
- Areas with prevalent runoff to be identified and drainage actively managed, e.g. through bunding and / or temporary drainage.
- Areas at risk of spillage, such as vehicle maintenance areas and hazardous substance stores (including fuel, oils and chemicals) to be bunded and carefully sited to reduce the risk of hazardous substances entering the drainage system or the local watercourses as far as practicable. Additionally the bunded areas would have impermeable bases to limit the potential for migration of contaminants into groundwater following any leakage / spillage. Bunds used to store fuel, oil etc. would have a 110% capacity of the volume of fuel, oil etc. to be stored.
- Disturbance in areas close to watercourses reduced as far as practicable.
- Excavated material to be placed in such a way as to avoid any disturbance of areas near to the banks of watercourses and any spillage into the watercourses.
- Construction materials to be managed in such a way as to effectively reduce the risk posed to the aquatic environment as far as practicable.
- Plant machinery and vehicles to be maintained in a good condition to reduce the risk of fuel leaks.
- Drainage works to be constructed to relevant statutory guidance and approved by NRW and Wrexham County Borough County Council prior to the commencement of construction.
- Consultation with NRW during the construction period to promote best practice and to implement proposed mitigation measures.

Construction Waste

2.154 The specialist EPC contractor hired to construct the Proposed Development will ensure that any waste that is required to be taken off site will be disposed of responsibly to registered waste companies during and immediately following construction.

2.155 The potential waste generated during the construction process will primarily be related to packaging and will include:

- Any non-hazardous waste (likely to be primary packaging and cable off cuts) - will be stored in a covered skip and recycled or approriately disposed of.
- Food waste from workers – personal rubbish will be collected along with no-recyclable packaging materials, for disposal at an appropriate recycling centre or landfill site.
- Excavated soil – the site will require some ground works for access tracks, cable trenching and equipment platforms. Excavated soil will be used for backfilling activities. Any excess subsoil will be removed from the site and disposed of at an appropriate landfill or sold to a landowner needing additional soil.

Use of Natural Resources

2.156 The detailed CEMP will consider the main types and quantities of materials required for the Proposed Development to assess potential for sourcing materials in an environmentally responsible way.

2.157 The detailed CEMP will include measures relating to the use of resources, including categories in relation to minimising the use of water. Any timbers used would be required to be Forest Stewardship Council (FSC) certified.

2.158 Additionally, the detailed Soil Resource Management Plan, as currently outlined in the oSRMP (**Appendix 10.1**), will include measures relating to handling of soils, how access will be managed to minimise impacts on soils; how soil damage will be minimised and ameliorated during works; and a methodology for monitoring soil condition, and criteria against which compliance will be assessed. The SRMP also specifies measures for protecting soils at decommissioning stage and a proposed restoration programme and after use.

2.159 The construction process would take into account the principles of good practice in soil handling and restoration set out in the following documents, wherever practicable, to reduce the possibility of damage to soil materials during the construction process:

- Ministry of Agriculture, Fisheries and Food (MAFF) (2000) Soil Handling Guide; and
- Department for Food and Rural Affairs (Defra) (2009) Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (including the Toolbox Talks).

2.160 The EIA Regulations also refer to the use of land and biodiversity resources. Further details are provided in Chapter 6: Biodiversity and Chapter 10: Soils of this ES, the outline Soils and Resources Management Plan (**Appendix 10.1**) and the ALC Survey Report (**Appendix 10.2**) and Planning Statement which accompany the planning application.

Residues and Emissions

2.161 Details of greenhouse gas emissions are set out in Chapter 9: Climate Change of this ES.

2.162 The detailed CEMP will consider ways of reducing construction activity residues and emissions as far as practicable, including but not limited to spills, noise and vehicle emissions during the construction phase.

Utilities

2.163 On site electrical power from generators will be utilised where necessary during the construction phase. It is not anticipated that new utility connections would be required for the construction compounds.

Vulnerability to Accidents and Disasters

2.164 Foreseeable construction hazards to the environment could include fire and flooding, though risk is considered limited with good construction practices.

2.165 Flood risk is assessed in the Flood Consequence Assessment (FCA) which accompanies this ES and within Chapter 8: Hydrology and Hydrogeology of this ES. The construction process includes measures to intercept run-off and control discharges from the Proposed Development in quality and volume, as well as water quality monitoring carried out throughout the construction phase so that no discharge of pollutants or increase in suspended sediment occurs.

2.166 The outline BSMP (**Appendix 2.1**) includes measures to reduce the risk of fire associated with the BESS on site. Safety control measures include:

- Appropriate battery chemistry selection – balancing energy density requirements against available volume and operating parameters.
- Cell level control – consideration of the use of battery technology incorporating Current Interrupt Devices (CID) and Positive Thermal Coefficient (PTC) protection, enabling the cell to disconnect from the battery in the event of cell failure.
- Implementation in the design of an approved Battery Management System (BMS) and a layered protection system.
- Safety certification and qualification.
- The ability for 24/7 Remote Monitoring and Control and automated shut-down.
- Off-gas detection to allow for preventative interaction.
- Lithium-Ion bespoke fire detection and suppression systems (FDSS) fitted to containers.
- Site Security and Monitoring.
- At a site and installation level – segregation of containers, maintenance of vegetation between BESS containers to provide a natural firebreak, provision of suitable and sufficient access / passing points for emergency services and communication with local emergency services and the provision of site maps, detailing BESS locations, access points and water sources.

Operation and Maintenance

2.167 Once operational, the Proposed Development will be monitored remotely and will not require any permanent staff to be positioned on-site. Occasional maintenance activities will be required, typically for solar panel cleaning and occasional visits for substation upkeep. This would equate to approximately 1-2 visits per month. Within the 40 year operational lifetime of the Proposed Development, there will be a requirement for routine or ad hoc replacement of some of the components including inverters, monitoring and control systems, and batteries. This will require some additional transport movements to the site during operation when this work is required to be undertaken, however the environmental effects associated with the replacement of modular equipment would be equal to or less than the effects identified within the construction and/or operational phase assessments contained within this ES.

Decommissioning

2.168 A solar project is a temporary and fully reversible use, unlike housing for example, with equipment removed from site at the end of the installation's operational life (approximately 40 years). The methods used in construction (limited concrete) mean that remediation works following the removal

of the panels and associated infrastructure are relatively minor and will return the site to its previous greenfield character.

2.169 A suitable decommissioning plan will be prepared prior to decommissioning of the Proposed Development in accordance with the latest legislation.

2.170 During decommissioning all infrastructure included in the solar farm will be dismantled and removed from the site, as follows:

- Solar Panels - The solar panels will be unscrewed from the mounting frames and packaged either to send to a solar recycling depot, or if they are still operational they may be sold as second hand. Since January 2014, PV panels in the UK have been covered by the WEEE Regulations, which require recycling of the panels at the end of their operational life. The Applicant is a member of the PV Cycle UK take back scheme for this purpose.
- Mounting Frames - The mounting frame horizontal poles will be removed and the piles will be pulled from the ground, the dismantled framework will be bundled and taken for recycling. Because of the slim line 'H' shape of the piles, they will not leave holes like fence posts and therefore only minimal soil back filling is likely to be required, if any.
- Cables - The cable trenches will be reopened, with the top soil set aside, and the cables and ducts will be removed. As the cables are removed, the trenches will be backfilled with the soil that has been set aside. The cables will be bundled and taken for recycling or sale to a scrap metal yard, and the ducts will be disposed of at an approved landfill.Where appropriate, some of the cables may be cut at a point where they are sufficiently buried and decomissioned in situ.
- Associated Equipment - The inverters, transformers, battery and switchgear cabinets / housing will all be removed from the sites using a crane and HGVs for transportation. They can then be broken down off-site, and any reusable parts salvaged for second hand or scrap metal sale, with the remainder disposed of at an approved landfill. The concrete bases for the cabinets / housing will be broken up and removed, this will either be on-sold to aggregate suppliers, or disposed of at an approved landfill. The area where concrete has been removed will then be backfilled with good quality soil.
- Safety and Security – The fencing and CCTV equipment will be removed from the sites, and sold on as second hand for reuse. Any holes left by the fence posts and poles will be backfilled with soil.

2.171 Following removal of all infrastructure from the site, and backfilling with soil of any areas requiring it, the sites will be harrowed and seeded in grass, where required. The swales will either be in-filled by new topsoil that will be brought to the site, or retained in place if the landowner considers it will provide an on-going benefit to the land.

2.172 There will be no elements of the solar of BESS installations left on the site – all infrastructure will be removed for recycling, reuse, or disposal at an approved landfill.

2.173 The potential impacts during decommissioning are similar to construction, and therefore similar mitigation and management measures will be implemented during the decommissioning phase.

2.174 The approach to the assessment across topic chapters has assumed that impacts associated with decommissioning would be equal to or less than those experienced during construction of the Proposed Development. Further detail is set out in the topic chapters.

Measures Adopted as Part of the Project

2.175 In order to avoid or reduce the environmental effects, a number of measures have been designed into the Proposed Development. Details of these can be found within each topic chapter of the ES and are summarised in **Tables 2.5** and **2.6** below.

Table 2.5: Schedule of Measures to be Adopted as Part of the Proposed Development during Construction

Topic	Proposed Measures during Construction
General / Design	Construction work will be kept away from tree root protection zones as set out in the Tree Protection Plan
Historic Environment	Where archaeological remains are found, a programme of archaeological investigation would be developed in consultation with the archaeological advisors to the planning authority. This would enable a better understanding of the presence, nature and date of any archaeological remains within those parts of the site where construction activities are planned and allow for the development of an appropriate strategy to avoid, reduce or offset any impacts that could occur as a result of construction. This programme should be a measure to offset the effect on historic assets and archaeological remains if any are found to be present and to be at risk from construction activities. In the event that the chosen cable route is to cross Offa's Dyke, as required Scheduled Ancient Monument Consent would be obtained which would require an assessment of the construction works. Detailed construction techniques would be developed in liaison with CPAT and Cadw which would consist of HDD methods.
Landscape and Visual	Trees retained and protected in line with the measures set out in the Tree Survey and Arboricultural Impact Assessment (see **Appendix 5.8**). HDD methods for cable installation to avoid impact on areas of existing woodland. Proposed planting included in the Landscape Strategy (see **Figure 5.10**) for the Proposed Development will be incorporated during the latter phases of construction as it would be likely to be damaged by construction activity.
Ecology and Nature Conservation	The Proposed Development will retain the hedgerow network and all of the mature and large semi-mature trees, maintaining the existing higher value biodiversity features over the lifetime of the Proposed Development. The retention of mature and semi-mature trees will preserve habitat with intrinsic value which would otherwise not be possible to re-establish over the lifetime of the Proposed Development. The perimeter fence has been specifically aligned to be outside the canopy spread of each of the hedgerow trees locally increasing the stand-off from field boundaries. Where the perimeter security fencing is installed, it will be set back from the hedgerow / top of ditch bank by 4m with an additional 6m buffer between the fencing and solar arrays to protect these habitats from adverse change during construction or once the solar farm is operational. Openings for mammals will be created at regular intervals along the base of the perimeter fencing to provide access points for badgers, and other mammals, allowing them to move around and through the operational solar farm. Pond P2 will be protected with a 10m stand-off between the perimeter fencing /edge of the working area and the pond margin, with the solar arrays located 16m from the pond. All other ponds will be over 60m from the working area. There will be no construction, storage or access within 10m any of the ponds during construction. There will be a minimum stand-off of 25m from all the canopy edges of each of the off-site woodlands. Where practicable, the temporary roads required for construction, operational maintenance and decommissioning of the solar farm are aligned to existing access points through hedgerows (excluding the southern construction access).

Topic	Proposed Measures during Construction
	Gaps in hedgerows will be widened where necessary to enable access for the vehicles required for installation and decommissioning. The temporary roads will be built up above the existing ground level in all of the root protection areas of trees and hedgerows. The majority of the cabling associated with the Proposed Development will be laid underground via surface dug trenches of approximately 1m deep and 50cm wide and backfilled. These will utilise existing access tracks and road options wherever practicable. The cable route will avoid the wooded section of the River Clywedog, with the river crossing aligned to an existing bridge where the bankside vegetation is managed as amenity grassland, in close proximity to Bersham Lane. An oCEMP has been prepared (**Appendix 2.2**) which sets out measures to be followed during construction.
Traffic & Transport	An oCTMP has been prepared to reduce deliveries from sensitive areas as far as practicable (**Appendix 2.3**) A weekly booking system will be implemented for the delivery of plant and materials. The Applicant will strive to procure local contractors, thereby minimising transport costs and impact on the local environment. All delivery vehicles will be required to switch off their engines as they are waiting at the site, thereby preventing unnecessarily idling vehicles. Use of the permitted vehicle routes shall be included as a contractual requirement and will be communicated to all individuals associated with the works.
Noise & Vibration	Good practice guidance will be implemented throughout the construction stage. Standard industry practice measures would control and manage construction noise to avoid significant adverse effects.
Climate Change	Where practicable, pre-fabricated elements would be delivered to the site ready for assembly, which will reduce on-site construction waste and reduce vehicle movements as part of the construction process. Construction materials should be sourced locally where practicable, to reduce the impact of transportation. Vehicles used in road deliveries of materials, equipment and waste arisings on- and off-site would be loaded to full capacity to reduce the number of journeys associated with the transport of these items. All staff members will be encouraged to car share where practicable and to arrive on-site prior to the AM network peak hour. All machinery and plant would be procured to adhere with emissions standards prevailing at the time and should be maintained in good repair to remain fuel efficient. When not in use, vehicles and plant machinery involved in site operations would be switched off to further reduce fuel consumption. Where practicable, local waste management facilities would be used to dispose of all waste arisings, to reduce distant travelled and associated emissions. The volume of waste generated would be reduced so far as practicable, and resource efficiency maximised, by applying the principles of the waste hierarchy throughout the construction period. Segregated waste storage should be employed to maximise recycling potential for materials. Equipment and machinery requiring electricity would only be switched on when required for use. Procedures should be implemented so that staff adhere to good energy management practices, e.g. through turning off lights, computers and heating/air conditioning units when leaving buildings.

Topic	Proposed Measures during Construction
Soils	Appropriate construction techniques will be implemented to reduce above and below ground works and to reduce any compaction of soil as far as practicable, mitigating any potential impact on the soil structure and ability to infiltrate water. The construction process would take into account the principles of good practice in soil handling and restoration wherever possible, to reduce the possibility of damage to soil materials during the construction process. Specifically in the areas of more heavily loaded or enclosed structures further investigation is recommended to determine the depth and nature of backfill of opencast workings and to provide geotechnical information in support of design of foundations/anchors. Standard construction protocols in accordance with CDM Regulations (2015) will be adopted during construction. An oSRMP has been prepared (**Appendix 10.1**) which sets out soil handling measures during construction.
Hydrology & Flood Risk	Dust suppression equipment would be used to reduce the spread of sediment within the site, so that any dust created during construction is diverted into specific drainage systems equipped with sediment interceptors. Construction material and / or spoil within construction compounds would be positioned away from surface watercourses / significant ecological areas (where available) and no hazardous substances would be stored within close proximity of the drainage network. The main construction compounds and storage areas would be positioned within the western part of the site away from the surface watercourses. Any area at risk of spillage, such as vehicle maintenance areas and hazardous substance stores (including fuel, oils and chemicals) would be bunded and carefully sited to reduce the risk of hazardous substances entering the drainage systems, the local watercourses as far as practicable. Additionally, the bunded areas would have impermeable bases to limit the potential for migration of contaminants into surrounding watercourses and significant ecological habitats following any potential leakage/spillage event. In line with standard building practices and as a precautionary measure, it is recommended that ground floor threshold levels of ancillary buildings would be raised a minimum of 150 mm above external ground levels, where feasible. Disturbance in areas close to watercourses reduced as far as practicable. Excavated material to be placed in such a way as to avoid any disturbance of areas near to the banks of watercourses and any spillage into the watercourses. Construction materials to be managed in such a way as to effectively reduce the risk posed to the aquatic environment so far as practicable. Plant machinery and vehicles to be maintained in a good condition to reduce the risk of fuel leaks. Drainage works to be constructed to relevant statutory guidance and approved by NRW and WCBC prior to the commencement of construction. The measures set out above are detailed in the oCEMP (**Appendix 2.2**).

Table 2.6: Schedule of Measures to be Adopted as Part of the Proposed Development during Operation

Topic	Proposed Measures during Operation
General / Design	The design of the Proposed Development is generally low-lying in nature, typically shorter in height than the many existing mature trees and hedgerows around the site. Once in operation, this will mitigate against any likely change in the character of the landscape.

Topic	Proposed Measures during Operation
Historic Environment	No archaeological effects are anticipated at the operational stage and therefore no further mitigation measures are required in terms of archaeology. No mitigation measures are required with regard to built heritage receptors within the study area, taking into consideration the distance at which they are located from the site and minimal visual effects which will likely arise as a result of the Proposed Development. The implementation of proposed landscaping would, however, assist to soften the limited views of the Proposed Development which may exist.
Landscape & Visual	Internal and boundary hedgerow reinforcement appropriate to the arable and pastural fields that would improve the site's existing field structure, enhancing biodiversity and habitats for local wildlife and provide additional screening of the site and solar PVs within views. Woodland edge scrub planting is proposed adjacent to existing areas of established woodland to improve connectivity and integration within the site. Structural woodland planting is proposed for the landscape treatment, where space allows and to help screen views of the solar PVs and enhance the wooded character within the site. Various meadow grassland mixes are proposed for different habitat creation that include a tussocky grassland for grazing beneath the solar PVs, woodland meadow for the connectivity of areas adjacent to existing woodland, wetland meadow of wet areas and a wildflower meadow. A landscaped area in the northern area would provide amenity opportunities and linkup to an existing PRoW network. Information boards are also considered to assist with raising awareness of the site's history, local biodiversity enhancements and educating about solar energy. Operation of the Proposed Development is to be undertaken in accordance with measures set out in the Landscape Strategy and LEMP, currently outlined in the LEMP (**Appendix 6.8**)
Ecology & Nature Conservation	The solar arrays will be installed within the existing improved and poor semi-improved grassland fields which will continue to be sheep grazed providing an efficient dual use of land for renewable energy generation and agriculture. Grassland between the perimeter fencing and field boundaries will be managed as tussocky grassland. The grassland will be managed with the objective of creating a patchy tussocky structure which will provide cover for amphibians, reptiles and small mammals and niches for invertebrates. Wildflower grassland will be created within the Biodiversity Enhancement Areas. No solar arrays will be installed in these areas, and they will be fully stockproof enclosed by fencing /continuous hedgerows. A new wildlife pond will be created within the Biodiversity Enhancement Area. Selected native marginal plant species (water forget-me-not Myosotis scorpioides, great willowherb Epilobium hirsutum, and water mint Mentha aquatica) will be plug-planted into the unshaded pond margins to further increase the biodiversity value of the pond and provide egg-laying opportunities for newts. New native hedgerows comprise a mixture of native shrub species will be planted along the boundaries of the Biodiversity Enhancement Areas. Over time these will improve connectivity and become part of the network of hedgerows. Defunct and species-poor hedgerows will be subject to infill planting with a mixture of native shrub species. The planting once established will be managed to maintain dense structured hedgerows of higher value for wildlife. Infill planting will directly improve connectivity on boundaries where there are currently gaps. Invertebrate banks will be created in the Biodiversity Enhancement Area at the north-west of the site. The banks will have south facing slopes constructed from stone and soil. Steep, bare earth sections will provide burrowing habitat for invertebrates. Management will seek to create a flower-rich open vegetation cover on the top of the bank with good populations of invertebrate foodplant species.

Topic	Proposed Measures during Operation
	Dense native species scrub will be created in the Biodiversity Enhancement Area at the north-west of the site. The scrub will be managed to provide nesting and foraging habitat for birds. Sections of winter cover crop will be sown to provide sources of food for farmland bird species foraging within the site during winter. Operation of the Proposed Development is to be undertaken in accordance with measures set out in the LEMP, currently outlined in the LEMP (**Appendix 6.8**)
Traffic & Transport	Given that the Proposed Development is being installed within fields using existing accesses, maintenance and inspection vehicle movements will replace the agricultural vehicle movements that the field generates. Thus, no specific mitigation is required given no intensification of use at the accesses during operation.
Noise & Vibration	Emissions from the solar element of the Proposed Development shall be free from noise and vibration at levels likely to cause pollution outside the site. Therefore, no specific mitigation is required in terms of noise and vibration for the solar element. There will be some noise emissions associated with the BESS element of the Proposed Development, specifically in relation to the Power Conversion Systems (PCS). As such, PCS will be contained within an acoustic barrier and fitted with filters to reduce the modelled noise levels to an acceptable level.
Climate Change	As a renewable energy development, climate change mitigation is an inherent aim of the Proposed Development. To ensure maximum energy yield, and therefore maximum GHG emissions displacement, the solar array would be south facing, and rows of panels would be distanced approximately 2.5m apart from one another to avoid inter-panel shading.
Soils	Following implementation of any required remedial measures identified as part of the ground investigation during the construction phase no further mitigation measures are considered necessary during operation. The Proposed Development is temporary in nature and fully reversible. The maintenance of grassland under the panels will, over time, increase organic matter within the soil, potentially improving its agricultural quality. Operation of the Proposed Development is to be undertaken in accordance with measures set out in the oSRMP (**Appendix 10.1**).
Hydrology and Flood Risk	The Proposed Development includes a drainage strategy in order to effectively control operational flood risk and water quality. Based on the flood risk identified and the nature of the Proposed Development, no specific mitigation measures are required to alleviate the risk of flooding.

References

Department for Food and Rural Affairs (Defra) (2009) Construction Code of Practice for the Sustainable Use of Soils on Construction Sites. [Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/716510/pb13298-code-of-practice-090910.pdf]

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Welsh Government (WG) (2021) Future Wales: The National Plan 2040. [Available online at: https://www.gov.wales/sites/default/files/publications/2021-02/future-wales-the-national-plan-2040.pdf]

3 NEED AND ALTERNATIVES CONSIDERED

Introduction

3.1 This chapter of the ES provides a summary of the need for the Proposed Development and a description of the reasonable alternatives considered by the Applicant during the evolution of the Proposed Development and through the EIA process.

3.2 It includes a summary of the reasons for the selection of the site, taking into account the effects of the development on the environment, together with a description of the alternative design and layout options that have been considered. Further information is provided in the Planning Statement and Design and Access Statement (DAS) that accompany the planning application.

Need and Benefits of the Proposed Development

3.3 The climate crisis and the ecological emergency are inextricably linked, and the threat posed by climate change to biodiversity is expected to increase. Well-designed and well-managed solar farms deliver clean, affordable energy. They can also offer additional benefits to the local environment, meaning that the UK's solar farms can make a significant contribution to both local and national biodiversity targets. Significant ecological gain can be achieved through establishing wildflower meadows and grasslands, hedgerows, woodland scrub, wetland habitats and land quality restoration. This has the potential to support the creation of a Nature Recovery Network across the country whilst benefiting rural communities through job creation and the provision of recreational and educational opportunities.

3.4 The need for the Proposed Development stems from two sources:

1. Energy security in the context of increasing demand for electricity; and
2. The need to decarbonise energy systems and combat the potentially devastating effects of climate change on the environment, and current and future generations.

3.5 The Proposed Development will provide a source of renewable energy, helping to reduce carbon emissions and contribute to Wales' net-zero goals, and contribute to the UK's ambition of a fivefold increase in solar energy generation, up to 70GW by 2035 as set out in the UK's Net Zero and Energy Security Strategy. It is estimated that the solar project could generate up to 57MWac of electricity, which is equivalent to providing enough power to meet the annual electricity needs of approximately 22,700 homes, saving 15,800 tonnes of carbon. Additionally, the energy produced once the Proposed Development is operational will reduce reliance on imported fossil fuel energy sources, providing greater energy security at a national scale.

3.6 The BESS will have an important part to play in managing the transition to a low carbon economy. The supply generated from the solar PV on the site, along with other renewable energy in Wales will be intermittent in supply, and energy storage can help balance supply and demand.

3.7 Consideration of need, having regard to the relevant national and local policy context, is provided below.

Welsh Government Declaration of Climate Emergency

3.8 In April 2019, the Welsh Government declared a climate emergency and in June 2019 accepted the CCC's recommendation for a new emissions target but set a more ambitious target of net zero emissions no later than 2050.

Welsh Government Commitment to Net Zero by 2050

3.9 On 9 February 2021, the WG set out its legal commitment to achieve net zero emissions by 2050.

3.10 In March 2021, new legislation came into force in Wales, amending the 2050 emissions target[1] and the interim emission targets[2]. As well as amending the 2050 emissions target to net zero, the 2030 target was increased from 45% to 63% below the 1990 baseline, and the 2040 target was increased from 67% to 89% below the 1990 baseline.

3.11 Evidence for the third UK Climate Risk Independent Assessment (CCRA3) in relation to Wales[3], highlights that the climate in Wales is already changing, with an increase of 0.9 degrees Celsius in the average annual temperature since the mid-1970s, an increase of 2.0% in annual mean rainfall and 6.1% in sunshine hours during the same period, approximately 1.4mm of sea level rise per year since 1901, and an increase in heat events.

UK Government Commitment to Net Zero by 2050

3.12 On 27 June 2019, the UK became the first major economy in the world to pass laws to end its contribution to global warming by 2050. The target will require the UK to bring all greenhouse gas emissions to 'net zero' by 2050, compared with the previous target set within the Climate Change Act (2008) of at least an 80% reduction of emissions by 2050 (against the 1990 baseline). In support of this target, the Energy White Paper: Powering our Net Zero Future (DBEIS, 2020a) was published, setting out the pathway to achieving net zero through greater reliance on solar and wind energy.

3.13 Net Zero 2050 – A Roadmap for the Global Energy Sector (International Energy Agency (IEA), 2021) outlines the essential conditions for the global energy sector to reach net-zero carbon dioxide (CO2) emissions by 2050. The Roadmap calls for scaling up solar and wind technologies during the 2020s, reaching up to 630GW of solar and 390GW of wind by 2030, four times the set levels in 2020.

3.14 The Roadmap stresses that for solar, this equates to installing the world's current largest solar farm roughly every day.

National Grid Future Energy Scenarios (July 2023)

3.15 'Future Energy Scenarios' (FES) (National Grid, 2023) outlines different credible pathways for the future of energy for the next 30 years and beyond. The document considers how much energy is needed and where the energy could come from. In all scenarios, the demand for electricity increases; this is brought about by shifting away from high carbon fuels to hit the Government's net-zero emissions target by 2050 and the predicted increase in electric vehicles ahead of the 2035 ban on petrol/diesel driven vehicles.

3.16 For electricity supply, in all scenarios, there are significant increases in renewable energy generation. The key messages of the FES report, with regards to the Proposed Development, include:

[1] The Environment (Wales) Act 2016 (Amendment of 2050 Emissions Target) Regulations 2021

[2] The Climate Change (Interim Emissions Targets) (Wales) (Amendment) Regulations 2021

[3] www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf

- Significant investment in low carbon electricity generation will be required across all net zero pathways;
- Between 55GW and 70GW of new wind and solar generation could be required to meet demand in 2035.

3.17 National Grid anticipates annual electricity demand in the UK could more than double from 286TWh in 2022 to up to 726TWh by 2050. Similarly, peak demand in 2022 of 58GW could almost double to up to 114GW over the same period. There is, therefore, an urgent need to increase electricity capacity in the UK to ensure a secure and stable supply in the future and achieve renewable energy and net zero targets.

National Planning Policy Context

3.18 Planning Policy Wales, Edition 12 published February 2024 (PPW), Future Wales - the National Plan 2040, published February 2021 (Future Wales) and Technical Advice Notes (TANs) set out the national planning policies of WG. Following the publication of Future Wales, TAN 8: Planning for Renewable Energy has been revoked and there is no longer an energy-specific TAN.

3.19 PPW paragraph 5.7.14 confirms that WG targets for the generation of renewable energy are:

- Wales to generate 70% of its electricity consumption from renewable energy by 2030;
- One Gigawatt of renewable electricity capacity in Wales to be locally owned by 2030; and
- New renewable energy projects to have at least an element of local ownership.

3.20 It is noted that it is vital that we reduce our emissions to protect our own wellbeing and to demonstrate our global responsibility. Future Wales together with PPW seeks to ensure the planning system focuses on delivering a decarbonised and resilient Wales through the places we create, the energy we generate, the natural resources and materials we use and how we live and travel.

3.21 Regarding energy generation, Future Wales identifies that Wales can become a world leader in renewable energy technologies. Wales' wind and tidal resources, potential for solar generation, its support for both large and community scaled projects and commitment to ensuring the planning system provides a strong lead for renewable energy development means it is well placed to support the renewable sector, attract new investment and reduce carbon emissions.

3.22 Future Wales contains two policies (17 and 18) of specific relevance to the Proposed Development.

3.23 Policy 17 – Renewable and Low Carbon Energy and Associated Infrastructure – expresses strong support for the principle of developing renewable and low carbon energy from all technologies and at all scales to meet our future energy needs. The policy states that in determining planning applications for renewable and low carbon energy development, decision-makers must give significant weight to the need to meet Wales' international commitments and our target to generate 70% of consumed electricity by renewable means by 2030 to combat the climate emergency.

3.24 In respect of large-scale solar, Policy 17 states that all proposals should demonstrate that they will not have an unacceptable adverse impact on the environment. It also expects proposals should describe the net benefits the scheme will bring in terms of social, economic, environmental and cultural improvements to local communities. New strategic grid infrastructure for the transmission and distribution of energy should be designed to minimise visual impact on nearby communities.

3.25 Policy 18 – Renewable and Low Carbon Energy Developments of National Significance – deals with Developments of National Significance (DNS). It is a criteria-based policy which states that such developments will be permitted, subject to Policy 17, and the following:

1. outside of the Pre-Assessed Areas for wind developments and everywhere for all other technologies, the proposal does not have an unacceptable adverse impact on the surrounding landscape (particularly on the setting of National Parks and Areas of Outstanding Natural Beauty);
2. there are no unacceptable adverse visual impacts on nearby communities and individual dwellings;
3. there are no adverse effects on the integrity of internationally designated sites (including National Site Network sites and Ramsar sites) and the features for which they have been designated (unless there are no alternative solutions, Imperative Reasons of Overriding Public Interest (IROPI) and appropriate compensatory measures have been secured);
4. there are no unacceptable adverse impacts on national statutory designated sites for nature conservation (and the features for which they have been designated), protected habitats and species;
5. the proposal includes biodiversity enhancement measures to provide a net benefit for biodiversity;
6. there are no unacceptable adverse impacts on statutorily protected built heritage assets;
7. there are no unacceptable adverse impacts by way of shadow flicker, noise, reflected light, air quality or electromagnetic disturbance;
8. there are no unacceptable impacts on the operations of defence facilities and operations (including aviation and radar) or the Mid Wales Low Flying Tactical Training Area (TTA-7T);
9. there are no unacceptable adverse impacts on the transport network through the transportation of components or source fuels during its construction and/or ongoing operation;
10. the proposal includes consideration of the materials needed or generated by the development to ensure the sustainable use and management of resources;
11. there are acceptable provisions relating to the decommissioning of the development at the end of its lifetime, including the removal of infrastructure and effective restoration.

3.26 Policy 18 also requires that the cumulative effects of the Proposed Development are considered.

3.27 The application documents, including this ES, assess the above criteria (where relevant) and there are no unacceptable adverse effects on the receptors identified in the Policy 18 criteria.

Local Policy Context

3.28 The development plan for the site for the purposes of Section 38(6) of the Planning and Compulsory Purchase Act 2004 comprises:

- Future Wales: The National Plan 2040 published February 2021; and
- the Wrexham Local Development Plan 2013 – 2028 adopted December 2023 (LDP).

3.29 Policy RE2 Renewable Energy Schemes of the LDP supports the generation of energy from renewable sources provided that an assessment of the impacts of the development on the landscape, the number, scale, size, design and siting of renewable installations and associated infrastructure, alone, cumulatively and in combination is undertaken.

Overall Need and Benefits

3.30 Overall, there is a significant need to increase electricity supply based on predictions of future consumption due to electrification of transportation and heating in particular.

3.31 Given the climate emergency and legally binding net zero targets, there is a need for the electricity to be produced from zero or near zero carbon and greenhouse gas emission sources.

3.32 Solar power, and other sources of renewable energy, have an important role to play as part of the mix of energy sources required to meet increasing electricity demand in the future and national carbon and greenhouse gas reduction targets, in particular the Welsh and UK Government's legally binding targets of net zero carbon emissions by 2050.

3.33 In summary, the benefits of this solar and BESS project, include:

- The Proposed Development will generate enough affordable clean electricity to meet the annual equivalent needs of 22,700 households per year. We are still in a cost-of-living crisis caused in part by high energy bills. Solar is currently one of the cheapest forms of energy generation and this solar farm can help contribute to reducing customers energy bills.
- The Proposed Development will help tackle climate change, the effects of which are clear to see with more frequent extreme weather events. The solar farm will save 27,000 tonnes of carbon per annum, reducing greenhouse gas emissions and helping the UK and Welsh Governments meet their climate targets. Climate change has also been identified as the greatest threat to food security around the world by numerous bodies, including the National Farmers Union.
- Solar and BESS projects can help sustain the farming businesses for the long-term future. By establishing a valuable revenue stream, it will enable reinvestment back into more productive parts of the land, ensuring food security. Indeed, the NFU support solar farms for this very reason. Farmers are faced with high fertiliser and energy costs, fluctuating incomes and uncertainty around future subsidies. Moreover, the effects of climate change, with extreme flooding and droughts, significantly reduce farmers yields and can push them out of business if they have not got alternative revenue streams. Various research has shown that even if the UK Government were to meet its target of 70GW of solar by 2035, it would only take up 0.5% of land in the UK.
- The Proposed Development will help contribute to greater energy security in Wales and the UK, and less reliance on importing costly gas from abroad.
- A community benefit fund of £57,000 will jointly be established for Coedpoeth and Esclusham Community Councils, and a further £400,000+ will be invested in local projects and initiatives.
- The application will significantly improve biodiversity in the local area. The new native tree and hedgerow planting, along with new wildflower meadows will create new and enhanced habitats for wildlife.
- The application will also pay business rates to Wrexham Council of around £3.3 million associated with the operation of the solar panels over its 40-year operational lifespan, this figure would increase upon commissioning of the BESS.

Alternatives Considered

3.34 The EIA Regulations 17 3(d) require that an ES should include:

'A description of the reasonable alternatives studied by the applicant..., which are relevant to the proposed development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the significant effects of the development on the environment.'

3.35 Paragraph 2 of Schedule 4 of the Regulations expands slightly on the information for inclusion in ESs and states:

'A description of the reasonable alternatives (for example in terms of development design, technology, location, size and scale) studied by the applicant..., which are relevant to the proposed development and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects..' (Schedule 4 (2))

3.36 This section therefore sets out the reasonable alternatives considered and the key reasons for the selection of the Proposed Development site and current layout, taking into account environmental effects.

'Do nothing' scenario

3.37 Under the 'Do nothing' scenario, the majority of site would continue to be used for agriculture. The benefits of producing renewable energy to feed into the electricity distribution network and help the Welsh and UK Governments to respond to energy security needs, the climate emergency and reach greenhouse gas reduction and net zero targets by 2050 would not be contributed towards in this scenario.

3.38 The hedgerows and trees would remain in situ and the field margins would continue to be managed. Due to this management (including maintaining short grasses and heights of hedgerows) the habitat value of the field margins would remain species poor.

3.39 In contrast, the Proposed Development would result in ecological benefits. The introduction of landscape and biodiversity enhancement areas, together with changing the management regime of the field boundaries (such as alternative cutting programmes and the absence of pesticides and herbicides from spray drift), the floristic diversity of the field margins and the habitats they provide would increase through the use of a species rich grassland which may include wildflower meadows. The introduction of the habitat enhancement areas would increase habitation for great crested newts and provide a greater variety of flora species. Under the 'Do–nothing' scenario, these benefits would not be achieved.

3.40 The site is currently in agricultural use, with the large majority under grazing. The Proposed Development will continue to allow agricultural use, in particular sheep grazing, across areas of the site.

3.41 In summary the Proposed Development, compared to the 'Do Nothing' Scenario will maximise the potential benefits if the site as it will enable the generation of green, renewable energy supporting Wales and the UK in meeting targets for Net Zero and energy security, as well as boost biodiversity, whilst allowing for continued agricultural use.

Site Location

3.42 The Applicant is committed to delivering renewable developments across the UK to meet the changing needs of current and future generations. In the context of the current climate emergency

and the national commitments to meet net zero targets, there is an increased demand to obtain our energy requirements from green sources across the whole of the UK in locations where renewable technologies are optimised to maximise site efficiencies. The Applicant undertakes continuous nationwide assessments of land opportunities but, in order for schemes to progress, this must be where land is available in agreement with landowners' commitments to supporting the provision of green energy production to meet a sustainable future.

3.43 Large scale ground mounted solar farms are generally located in the open countryside. Sites large enough to accommodate a financially viable scheme, with sufficient MW output, are difficult to find in or close to settlements, particularly the towns and villages that are found in the area local to the Proposed Development, in particular there are:

- Not enough rooftop areas or existing brownfield land available and competition from other high value sectors such as residential and mixed use for such sites;
- Unsuitable roof structures and standards (including roof orientation, shading, presence of plant and other equipment);
- Complex multiple landlords/tenant agreements; and
- Sites within settlements are likely to be considerably more visible to more people.

3.44 It is rare to find a site which meets all the other requirements for a large-scale solar farm, such as close to a point of connection with capacity, with no significant environmental designations or features, and minimal impact on the environment.

Overview of Site Selection

3.45 Once a potential site location is identified, the Applicant undertakes a more detailed site selection process. This process is critical to ensuring that an efficient, technically and economically viable solar and BESS project can be developed without causing unacceptable significant adverse environmental effects.

3.46 An evaluation of site constraints and opportunities was undertaken to inform an initial concept design. This has subsequently been refined through a combination of technical assessments and engagement with various stakeholders. As a result, the Proposed Development presents an opportunity to provide the following:

- Approximately 57MWac of renewable electricity to feed into the electricity distribution network and support the Government's Net Zero targets.
- Approximately 57MWac of storage capacity allowing surplus energy generated at times of high production to be stored and dispatched to the grid at times when the energy is needed.
- Provide areas of habitat enhancement.
- Allow for continued agricultural use.

3.47 In assessing the suitability of a site, the following criteria are considered:

1. Technical suitability of the site for construction and operation
    a. Topography and ground conditions
    b. Amount of daylight (or irradiance)
    c. Size
    d. Orientation

e. Accessibility

2. Grid connection feasibility

    a. Proximity of nearest point of connection (Legacy Substation)
    b. Availability of grid capacity at the substation
    c. Accessibility substation to connect to via cables

3. Planning constraints

    a. Planning designations, both national and local level
    b. Existing land use
    c. Landscape designations
    d. Ecological designation
    e. Heritage designations
    f. Flood risk
    g. Neighbouring land uses
    h. Potential visual receptors
    i. Presence of Best and Most Versatile (BMV) Agricultural Land.

4. Site Availability

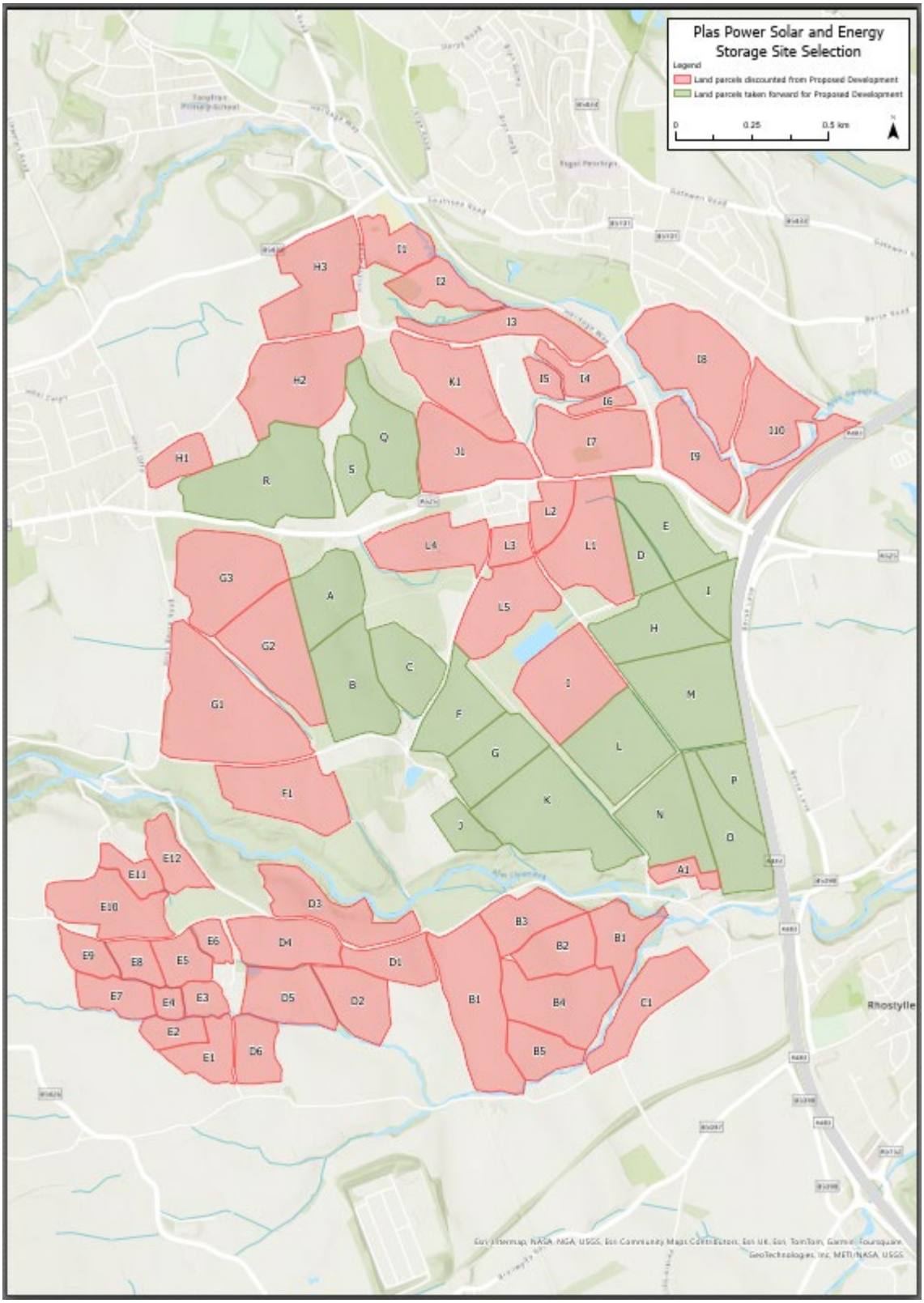
3.48 The Applicant needs a willing landowner in order to develop a project. Once the above criteria have been taken into account, it is often that agricultural land is the most suitable option for proposed solar development as is the case for the Proposed Development. The Plas Power site, now predominantly in agricultural use, was formerly an open-cast coal mine. An added benefit to landowners is that a solar lease with the Applicant can provide long-term predictable income, as well as the opportunity to continue agricultural use on the solar land.

3.49 The site selection process identifies potentially suitable land / fields for the Proposed Development, and once established, the site layout and design is further developed. Careful consideration of various factors including, but not limited to engineering constraints, generating capacity and environmental constraints, have helped to guide the design of this project. Environmental constraints were given particular regard and often prioritised wherever practicable when making design decisions. The design has evolved through several iterations following consideration of environmental factors and consultation with local stakeholders. The site selection process and design development is described below.

Site Selection

3.50 The Applicant considered and appraised a number of parcels of land, and fields, in proximity to the Legacy Substation as summarised below. The parcels and fields are referenced and annotated in **Plate 3.1** below.

Plate 3.1 Site Selection



3.52 From 2014, land parcels were appraised based on the criteria outlined above to determine which land parcels would be suitable for solar development. Land parcels with minimal environmental and planning constraints were taken forward for further consideration within the design of the Proposed Development.

Land to the south of the A525

3.53 Between 2014 and 2023, central land parcels in the southern area (ref: L5, D, E, F, G, H, I, J, K, L, M, N, O, P and Q) were subject to a desk-based assessment and a site visit was undertaken in 2018. All these fields were considered to be suitable for the following reasons:

- Minimal environmental and planning constraints.
- Well screened due to existing woodlands, tree belts and hedgerows.
- Predominantly ALC Grade 3b land (not BMV) on the Predictive ALC maps.
- A number of well maintained wide access tracks through the centre of the site.
- Drainage ditches along the perimeter of the fields.

3.54 In 2018, parcels L1, L2, L3 and L4 were discounted due to nearby views from residential properties and undulating topography making it open to views from the A525. Parcel A1 was also discounted from the Proposed Development. This parcel represents the southern section of parcel O which runs adjacent to a footpath and is located closest to the residential dwelling. The reason for removing this section of the field was because of views from the Bersham Ironworks Museum (including the carparking / picnic area), residential property and footpath.

Land to the north of the Legacy Substation

3.55 In 2018, land parcels D1, D2, D3, D4, D5 and D6 to the north of the Legacy Substation were assessed by desktop assessment as unsuitable for development and therefore discounted from the Proposed Development. The reason being that they were constrained by PRoWs, Scheduled Ancient Monuments (DE132 – Offa's Dyke and DE131 – Cadwgan Hall Mound) and were located within proximity to (or within) selected parcels of an operational farm/dwelling.

3.56 Again, in 2018, land parcels E1, E2, E3, E4, E5, E6, E7, E8, E9, E10, E11 and E12 to the north of the Legacy Substation were assessed by desktop assessment as being unsuitable for development as the land would be visible from intersecting highways and residential properties and were therefore discounted.

Land to the west

3.57 In 2019, land parcels to the west of the southern area (ref: F1, G1, G2, G3, A, B and C were assessed. Fields referenced F1, G1, G2 and G3 were assessed and considered less suitable for solar development for the following reasons:

- A section of Offa's Dyke in Plas Power Park runs through the south western corner of the land.
- There is a Local Designated Site of Nature Conservation and Geological Importance, Big Wood Wildlife Site, to the immediate south as well as a public footpath.
- The land would be visible and from the adjacent Gate House (Grade II Listed Building) to the south-west corner and to properties along Rhos Berse Road, and opportunities to screen would be limited.

3.58 These land parcels were therefore not considered further and discounted from the Proposed Development.

3.59 The remaining land parcels (ref: A, B and C) were also assessed and considered better suited for solar development due to the topography, existing screening and accessibility with an internal estate track located to the south of C.

3.60 Whilst there would be some views from the access track and nearby properties, these were considered to be able to be readily screened due to the topography and the use of additional hedge planting. These parcels were therefore taken forward as part of the Proposed Development.

Land to the north-east of the A525

3.61 In 2019, the land parcels within the area of land to the north-east (north of the A525) (land parcels I1, I2, I3, I4, I5, I6, I7, I8, I9 and I10) were assessed, it was determined that the land is mostly Grade 2 agricultural land, with the majority within Flood Zone 3. There are also multiple visual receptors from Southsea and Rhosrhedyn and therefore the land was considered less suitable for solar development and not taken forward for inclusion in the Proposed Development.

3.62 Also in 2019, Land parcel K1 within the area of land to the north-east (north of the A525) was assessed and after initially being considered suitable was later discounted due to its close proximity with Local Designated Site of Nature Conservation and Geological Importance, Higher Berse Marsh Wildlife Site. The land was also found to be a primary resource coal designated area. In addition to these factors, the land parcel is constrained by two footpaths, is within Flood Zone 3 and has a scheduled monument on the western boundary.

Land to the south of Plas Power Woods and the Clywedog River

3.63 In 2019, land parcel C1 was assessed and considered unsuitable due to undulating topography and close proximity with residential properties.

3.64 Land parcels B1, B2, B3, B4 and B5 were considered potentially suitable for solar development due to its proximity to the Legacy Substation, topography and existing established screening which provides good visual containment, limiting visibility from sensitive receptors such as residential properties. It was however determined that there were sites of cultural and heritage sensitivity in the area including Offa's Dyke, several Listed buildings and the Bersham Ironworks Scheduled Ancient Monument (SAM). The area also comprised a mix of agricultural land grades, including Grade 2, 3a, and 3b. These parcels were included in the initial proposals consulted on in 2021, and also considered in the EIA Screening and Scoping undertaken in 2021 with PEDW.

3.65 Subject to further environmental assessment and responses to the consultation land parcels B1, B2, B3, B4 and B5 were omitted from the Proposed Development due to the cultural and heritage sensitivities in the immediately surrounding area and the grade of agricultural land, which when surveyed in detail, was assessed to be predominantly BMV.

Land to the north-west of the A525

3.66 In 2021, land parcels to the north (Ref: S, R, T, U, V, H2, J1) were assessed and a site visit was carried out. The majority of the parcels (S, R, T, U and V) are considered suitable for solar development, due to the following:

- No planning or environmental designations.
- Established hedgerows onsite and areas of woodland providing well established screening, and further set backs and planting can be readily incorporated to screen views from the A525 and near by residential properties.
- Accessibility off the north of the A525.
- The majority of the agricultural land is Grade 3b and not BMV.

3.67 The fields to the north (ref. H1, H2 and H3) were not considered suitable for solar development due to their sloping topography and their size and shape which would likely result in shadowing issues, and also due to the potential for long distance views from New Broughton.

3.68 Field J1 is predominantly Grade 2 and Grade 3a on the ALC Predictive Map and slopes downhill towards the south and has clear views from the A525. It was therefore not considered further.

3.69 There are small portions of Grade 3a land within a mosaic of Grade 3b to the north in H1, which have also subsequently been removed from the Proposed Development site.

Site Layout and Design

3.70 Following the site selection process outlined above, further design evolution and refinement of the land parcels selected for inclusion of the Proposed Development took place as detailed below.

3.71 The EIA process has influenced the iterative design process of the Proposed Development through the identification of the above constraints, responses to consultation undertaken to date and identification of environmental effects. As a result, the Proposed Development has undergone a number of design iterations and refinements. Further information on the design iterations is provided in the Planning, Design and Access Statement (PDAS) that accompanies this application, however the key changes are summarised below.

First Design Iteration

3.72 Prior to October 2019, an initial evaluation of site constraints and opportunities was undertaken to inform an initial concept design layout which was developed and subsequently submitted to WCBC as part of the initial pre-application process. This iteration took into account the site selection criteria in paragraph 3.45 above and is illustrated on **Plate 3.2**.

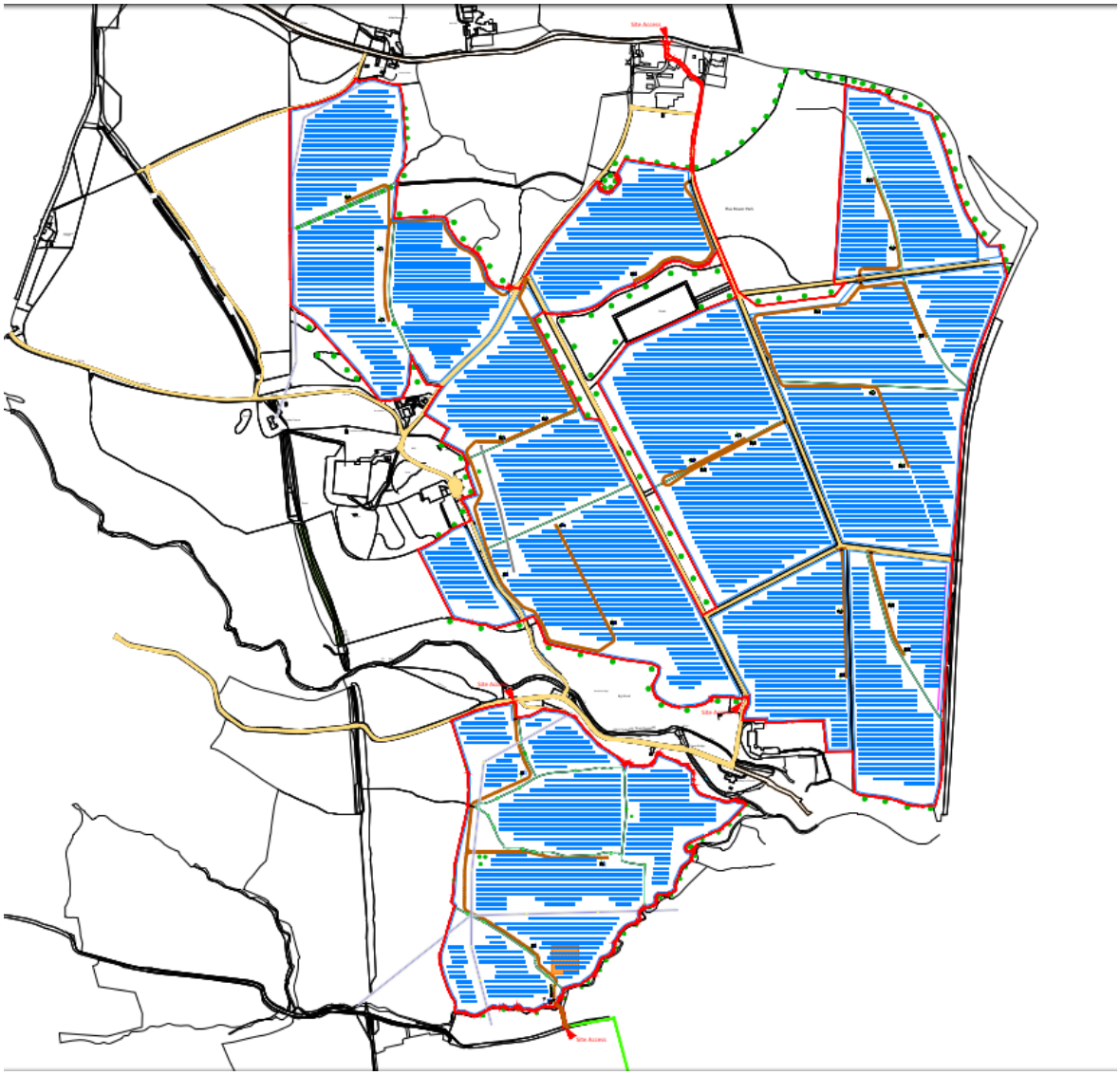


Plate 3.2: Internal layout submitted within 2020 EIA Screening and 2020 initial pre-application process.

Second Design Iteration

3.73 Following receipt of the initial pre-application response from WCBC a second iteration was produced taking into account matters raised by WCBC in respect of impact on heritage assets and biodiversity mitigation and enhancement. Setbacks from hedgerows were incorporated in response to comments received from the WCBC Ecology and Biodiversity Officer and proposals for access tracks were amended to improve accessibility for maintenance purposes.

3.74 This iteration also removed an area of solar panels which were located at a closer distance to Offa's Dyke than the current layout. This allowed for mitigation by design in respect of heritage impact.

3.75 This layout also included a set back from the residential properties to the south of the A525 (Home Farm) of approximately 100m therefore reducing adverse impacts on residential amenity compared to the alternative proposal without the setback.

3.76 This version of the design was submitted as part of the original scoping report submitted in October 2020 and also consulted on as part of the Community Consultation held in October 2021. This Layout is illustrated in **Plate 3.3** and is also contained in **Appendix 4.1.**

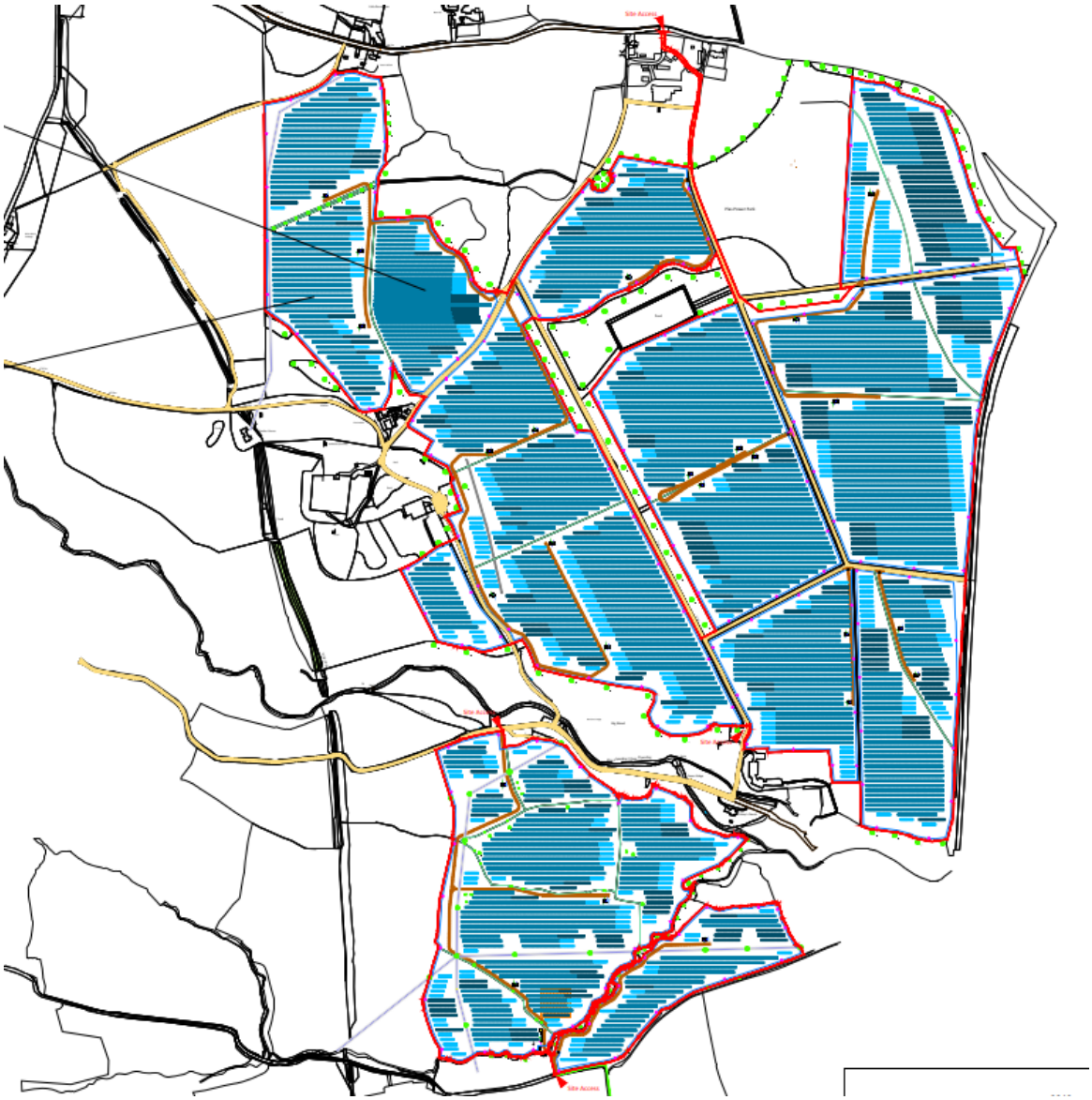


Plate 3.3: Internal layout submitted within 2020 scoping report and 2021 Community Consultation.

Third Design Iteration

3.77 The third design iteration was presented in the June 2023 Scoping Direction Request and also presented in the June / July 2023 non-statutory Community Consultation. This design iteration changed considerably from the version presented in the initial scoping report and Community Consultation of 2020 / 2021.

3.78 This iteration took into account the results of the topographical survey, tree surveys (incorporating the root protection areas) and the PRoWs running through the site.

3.79 A key change to the design development at this stage was the removal of the land parcels from the Proposed Development that are south of the Plas Power Woods. As discussed above in the site

selection section of this chapter, land parcels B1, B2, B3, B4 and B5 were removed due to the cultural heritage sensitivities in the immediate surrounding area and the grade of agricultural land, which when surveyed in detail, was assessed to be predominantly best and most versatile. The land parcels that were removed from the Proposed Development are outlined below in **Plate 3.4** and **Plate 3.5**.

3.80 Another key change to the design over this period was the inclusion of land parcels north of the A525 which were not included in the layout submitted initially in the 2020 scoping direction request and 2021 community consultation. This change is also referenced in the site selection section above, whereby land parcels R, S, T, U and V were subsequently determined to be suitable for siting PV panels for a variety of reasons but notably due to confirmation from the ALC Survey Report that the majority of the agricultural land is classified as Grade 3b and not considered to be best and most versatile. The relevant section of the layout showing the location of the parcels that were added to the Proposed Development are outlined below in **Plate 3.6** and **Plate 3.7**.

3.81 This iteration recognised the area of land adjacent to the A483 to the north of the site was safeguarded for junction improvement works. In 2022, plans were published to improve Junction 4 of the A483 to the north-east of the site, as a result the layout was subsequently updated to reflect the proposed plans for the junction improvements and safeguard the land from solar development. This was set out in the non-statutory Community Consultation in 2023. The Welsh Government has since however confirmed that the proposed junction improvements will not proceed. It is now therefore proposed to include this land within the Proposed Development, allowing for a more optimised site layout, reducing the potential environmental impacts further – in particular reducing the visual amenity impacts on the residents neighbouring the site. Refer to **Appendix 2.3** for further detail in respect of the location of these proposed works.

3.82 This iteration also introduced the landscape and ecology enhancement areas which are located on the western end of the northern area; on the southern end of the northern area between the solar panels and the A525 (west of the site access); and on the northern end of the southern area (between the panels and the existing residential properties).

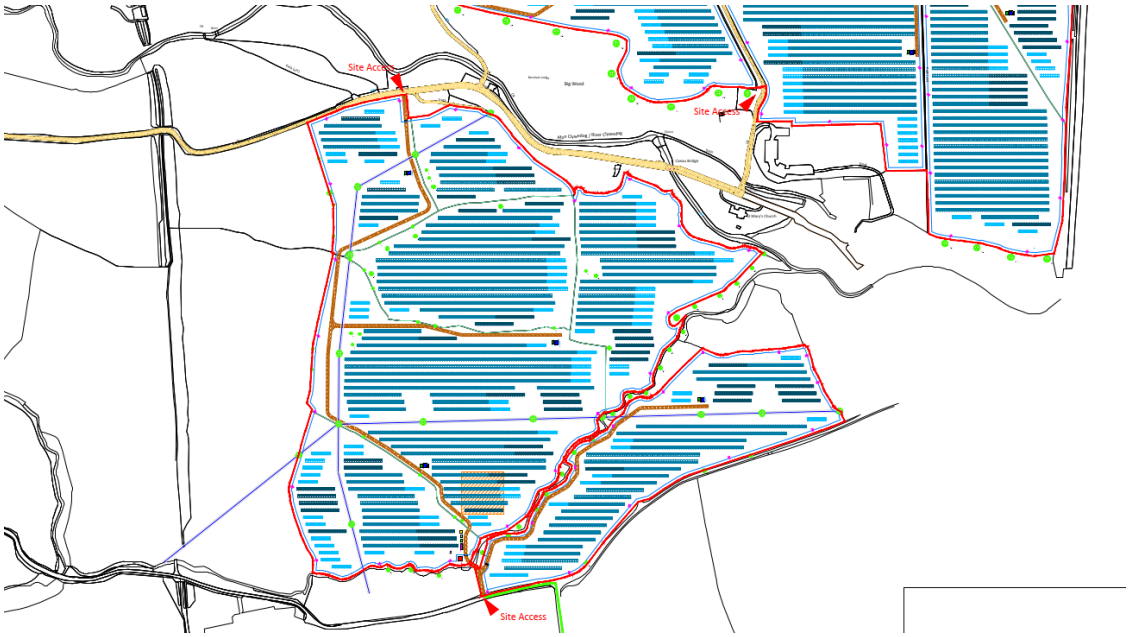


Plate 3.4: Extract from 2020 Scoping Direction Request report showing inclusion of PV panels in land parcels south of Plas Power Woods.

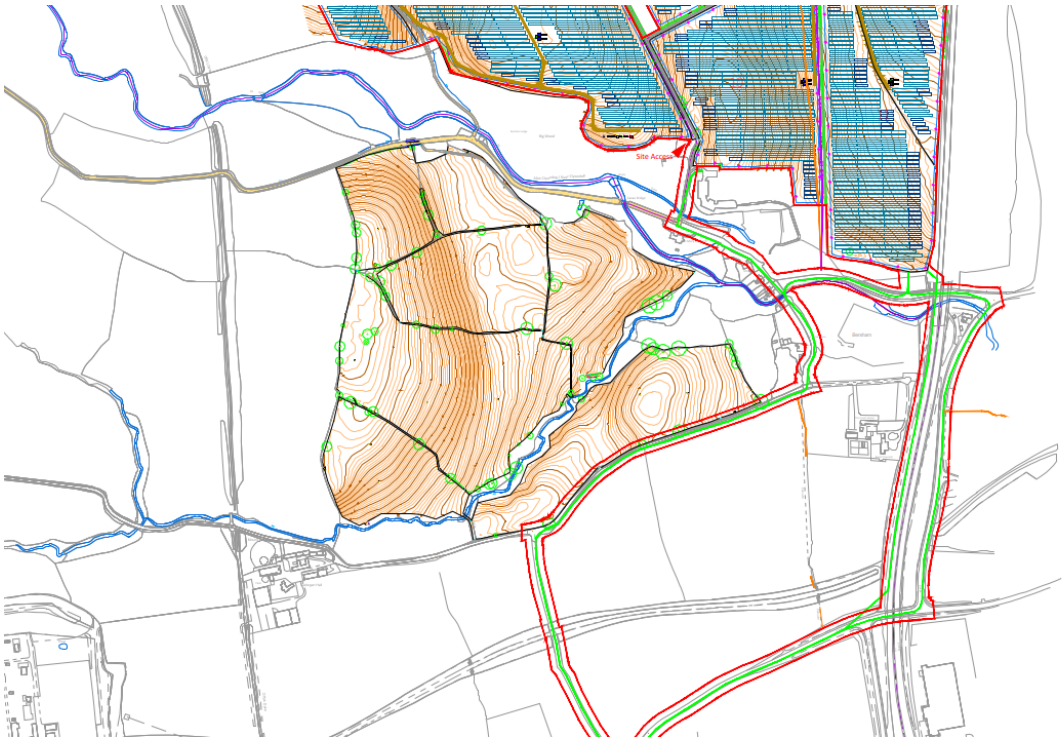


Plate 3.5: Extract from 2023 Scoping Direction Request showing exclusion of PV panels in land parcels south of Plas Power Woods.



Plate 3.6: Extract from 2020 Scoping Direction Request report showing exclusion of PV panels in land parcels north of the A525.

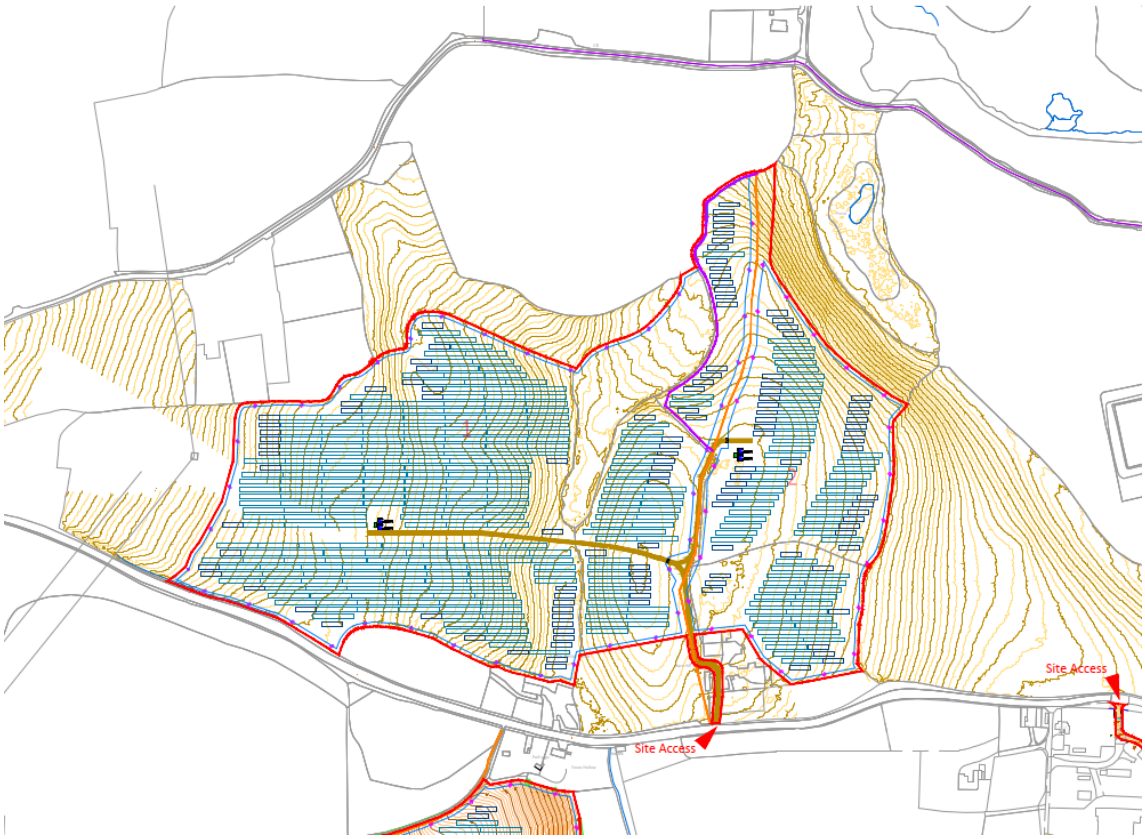


Plate 3.7: Extract from 2023 Scoping Direction Request showing inclusion of PV panels in land parcels north of A525.

3.83 Following further interrogation of the new land parcels north of the A525, agricultural land surveys identified that some of the land contained Grade 3a agricultural land, the areas containing ALC Grade 3a were subsequently removed from the site. Further details are available in **Appendix 10.2** ALC Survey Report. Topography and accessibility in the area to the north of the northern parcel were also constrained.

3.84 The overall layout presented in the 2023 Scoping Direction request and the 2023 Community Consultation is presented in **Plate 3.8**, this version can also be found in **Appendix 4.3** of this ES.

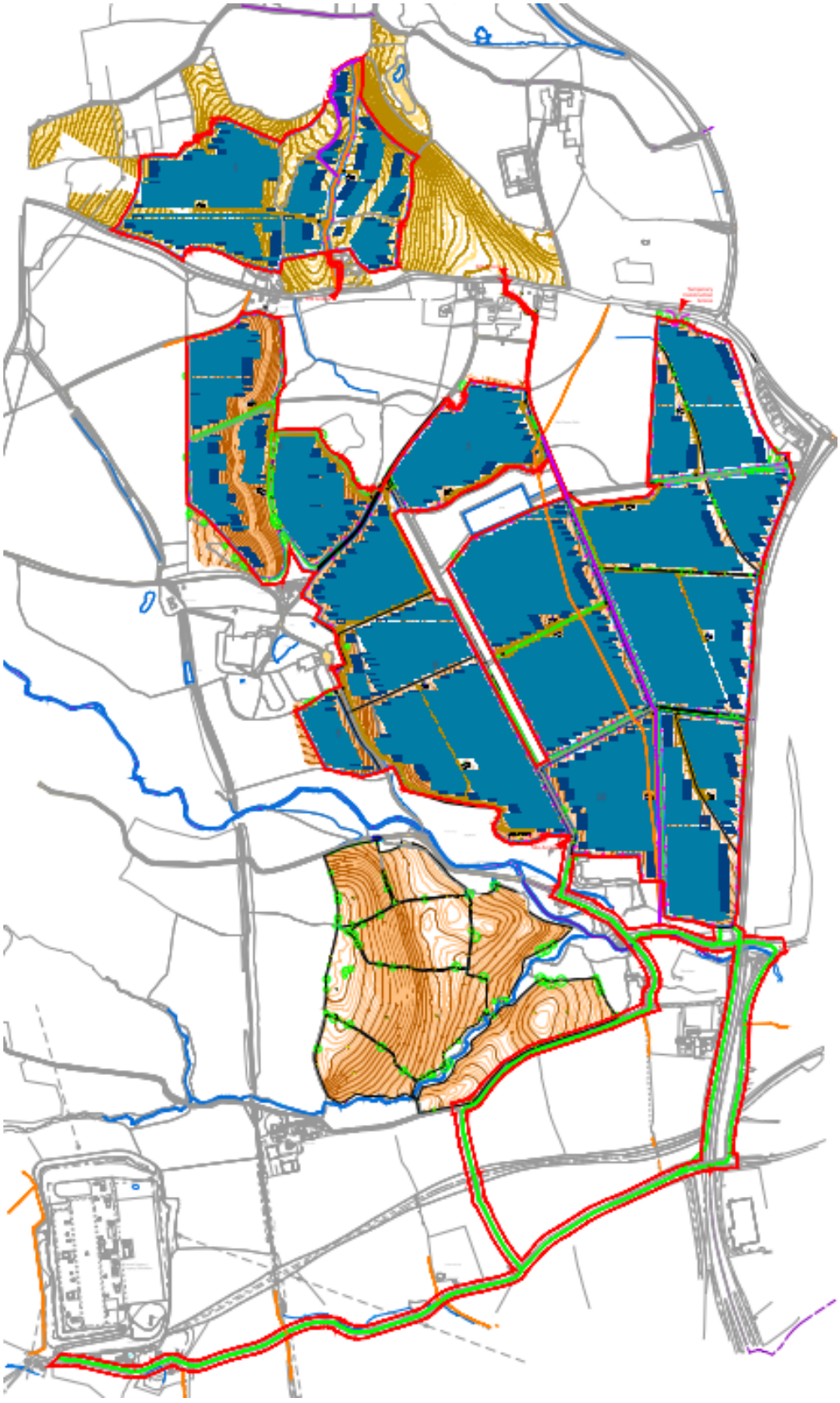


Plate 3.8: Internal layout presented in the 2023 scoping direction request and the 2023 community consultation.

Fourth Design Iteration

3.85 This design iteration was revised following the 2023 Scoping Direction issued by PEDW and in light of responses from the 2023 non-statutory Community Consultation and was presented within the pre-application consultation held between Wednesday 21st February and Tuesday 9th April 2024 and included the following changes from the third design interation.

South of the A525

3.86 Following the feedback from the non-statutory consultation, direct engagement with residents close to the site, and the output of the RVAA the layout south of properties south of the A525 has undergone further design alterations.

3.87 Further to the initial set back of 100m and screening between the site boundary and properties, the rows of solar panels were set back a further 50 metres (including removal of eight rows) from the properties south of A525 at Home Farm. As well as this, a further set-back for the properties at Foxes Hollow was proposed in October 2023.

3.88 The set back area between the properties as described above was designed to provide a greater level of visual screening, as well as areas for landscape and biodiversity enhancements. This proposed layout, including the landscape and biodiversity enhancements are shown in the extract on **Plate 3.9**. Visualisations of the proposed screening, landscaping and biodiversity enhancements were developed to allow the residents to develop an understanding of what views would look like 1 year after construction, and also 5 and 15 years after construction once the proposed mitigation planting had matured. The visualisations from The Meadows (View 1), Woodside Barn (View 2) and Foxes Hollow (View 3) are provided in **Appendix 3.1**.

3.89 Following the implementation of the visual screening outlined above and in **Plate 3.9** the RVAA determined that the Proposed Development would not trigger the Residential Visual Amenity threshold in relation to the visual amenity or liveability of any of the residential properties within the study area.

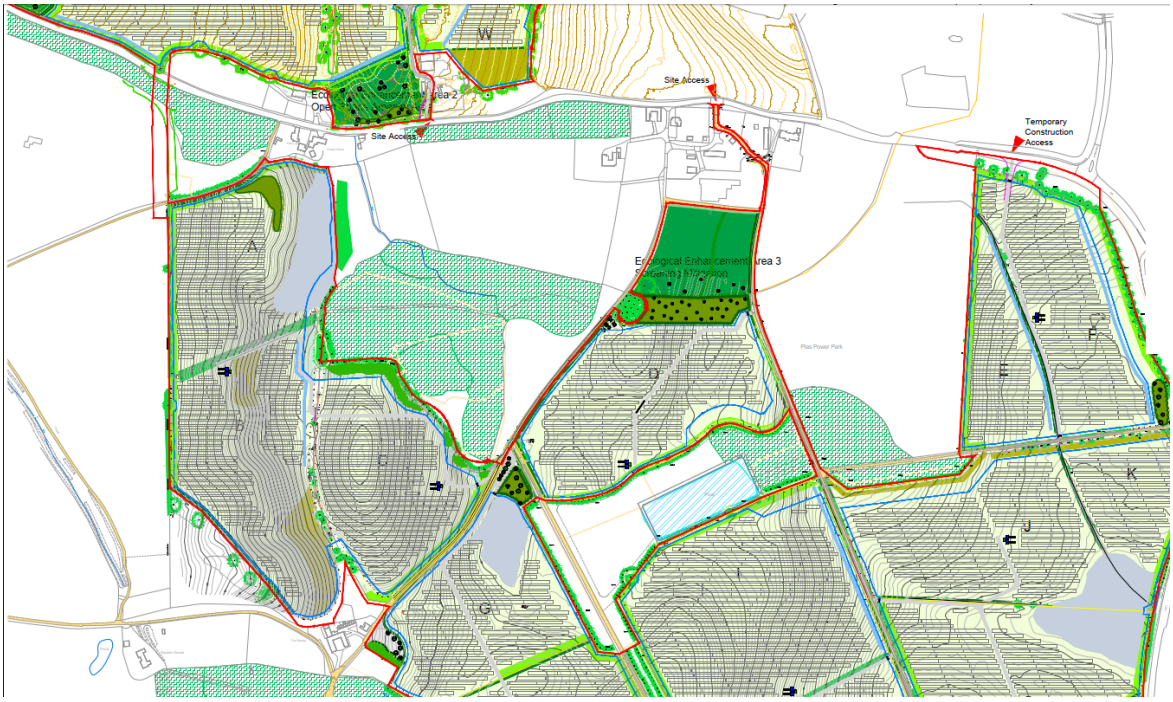


Plate 3.9: Landscape and Biodiversity Masterplan from Q4 2023

3.90 Following the changes described above, further engagement was held with the local residents south of the A525 and it was established that the level of setback proposed was still of considerable concern to the residents. As mentioned above, the conclusions of the RVAA determined that with the proposed setback and the implementation of mitigation and enhancements the Proposed Development would not trigger the residential visual amenity threshold in relation to the visual amenity or liveability of any of the residential properties. However, in continued dialogue with near residents, the Applicant revised the design to minimise impacts further and presented two design options (Option 1 & Option 2) in December 2023. Option 1 included the entire removal of land parcel D from the Proposed Development and is presented in **Plate 3.10**. Option 2 included the partial removal of panels from land parcels A, D and E (see parcel labels in **Plate 3.1**) and is presented in **Plate 3.11**.

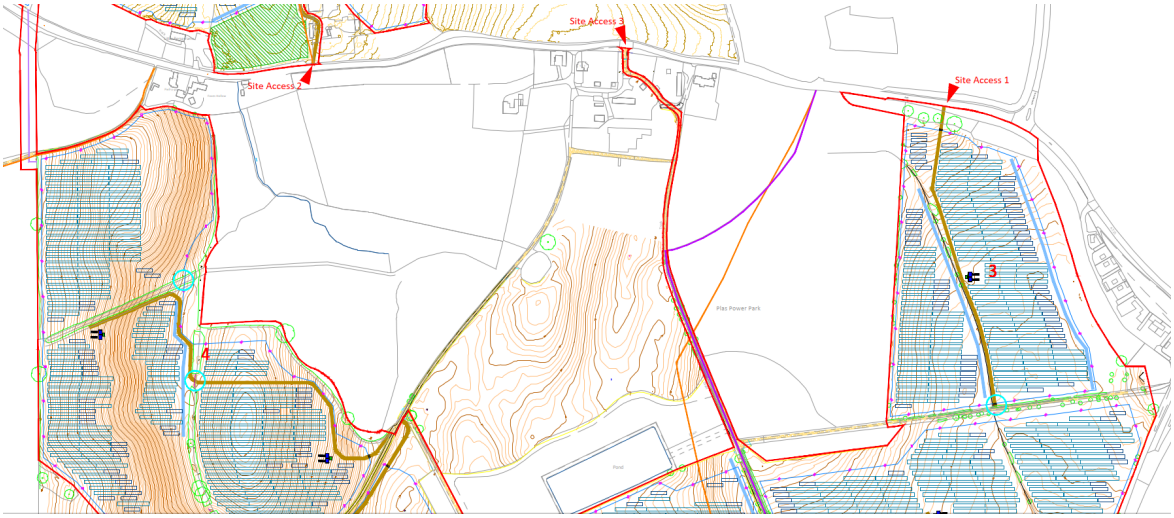


Plate 3.10: Option 1

3.91 Option 1 would reduce visibility of the panels from the properties at Home Farm south of the A525. There would not be the need for the mitigation tree belt and hedgerow planting directly south of these properties and the views looking due south from the properties would be mostly unchanged from the pre-development views. There would still be some limited visibility to the panels within the field to the east but, as shown when looking east in the visuals from within the garden to Woodside Barn, this would be mostly screened by year 5 and even more so by year 15 with the proposed planting. There would be slightly more open views from the upper floors of the eastern most properties, as per with the previous layout.

3.92 Overall, the near views from the Home Farm properties would be mostly unchanged and retain an open view over fields with a woodland backdrop. Any available views towards the panels in the east/south-eastern fields would by year 15 been mostly screened by additional hedgerow and tree planting, and the impact on views is considered negligible.

3.93 The views from Foxes Hollow to the west would be similar as the former layout, where there would be a partial view of the panels in the skyline from the property and garden. It is anticipated that by year 15 the panels would be fully screened by the mitigation planting proposed.

3.94 The removal of panels within this field would also reduce the effects upon the view from viewpoint 1 as identified in the ES Landscape and Visual Chapter, which is located on the footpath to the east of the field of panels to be removed within Option 1.

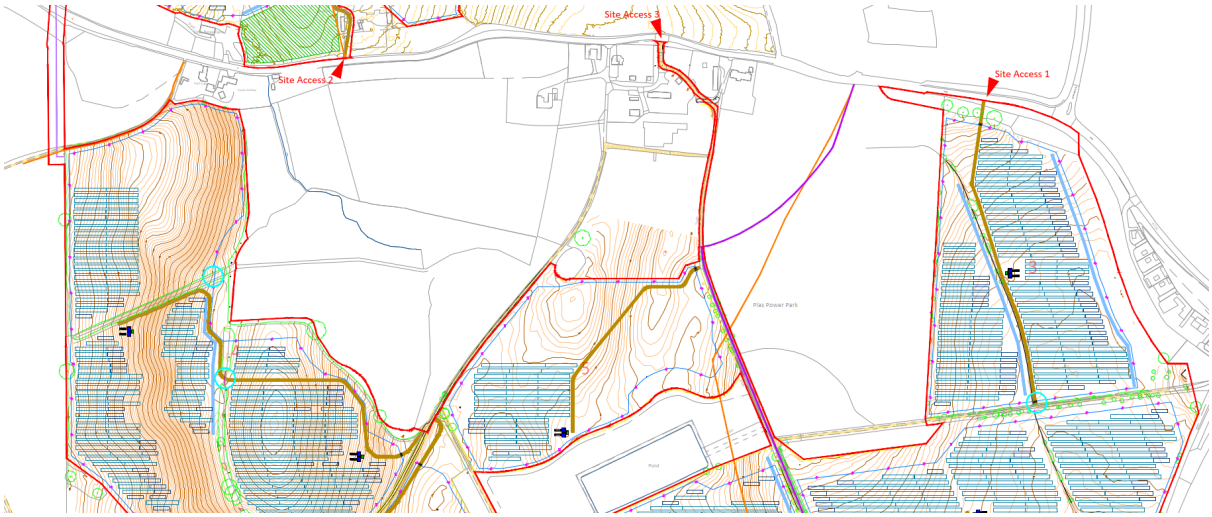


Plate 3.11: Option 2

3.95 In Option 2, the removal of the majority of panels within the field to the south of the residential properties at Home Farm would reduce the visibility from within these properties. In the most open views from the curtilages of the southern-most converted barns, the panels within the field would be just discernible and slightly screened by the landform, existing small woodland copse and mature oak trees within the right side of their views. Removing the panels would mean the new built elements would of the most part be set further back within available views and less dominant than within the previous layout at year 1. The fencing and access road would remain as per the previous layout within views.

3.96 The setting back of the panels from Foxes Hollow, would reduce their visibility on the skyline within views from within the property. The panels would still be visible within garden views, and likely break the skyline, but being set back would reduce their potential focus within the view.

3.97 The proposed tree belt as in the previous design would be removed in this option, however, the hedgerow with trees along the fencing along the northern boundary of the site would be retained to screen the fencing and access road, and aid in screening the panels set further back within the view, whilst retaining some openness. Where the panels have been moved to the east of the access track, there is some room to potentially put in some more woodland edge planting or a new hedgerow with trees to screen the panels on the northern most part of this field. The treatment for screening the development from Foxes Hollow would be similar to that of the previous layout, with a small area of new structural woodland and shrub planting, but moved further up the slope within field.

3.98 As per Option 1, the removal of panels within the field to the south of the properties off A525 would slightly reduce the effects upon the viewpoint 1, though not as much as Option 1. However, the setting back of panels to the other side of the access track and back from Foxes Hollow, would also slightly reduce the potential impact upon the footpath where it joins the A525 and the PRoW located to the west of Foxes Hollow, and slightly reduce the visibility of panels within the view from Viewpoint 3 to the west.

3.99 Panels are also proposed to be removed to the west of the proposed Site Access 2 which will minimise the impact on the easterly views from Woodside Barn.

3.100 Following feedback and further engagement in December 2023, a hybrid between Options 1 and 2 was agreed including the removal all panels from the field directly south of the Home Farm properties (as per Option 1) and removal of and setting back, with landscaping, south of Foxes Hollow (as per Option 2).

Setting back solar panels

3.101 In addition to the design options developed to set back solar panels from the properties south of the A525 discussed above, set backs to solar panels in other areas of the Proposed Development were also carried out in order to reduce impacts to sensitive receptors across the site. These are detailed below.

Plas Power Woods

3.102 In their consultation response, the Woodland Trust stated that a 15m setback should be provided from the Plas Power Woods to ensure root protection and accessibility to the trees. As a result, the Proposed Development has been designed to ensure the fence line is set back 15m from the Plas Power Wood, the solar development will then be set back a further 10m from the fence line, providing a total setback of 25m.

3.103 The Proposed Development therefore has reduced adverse environmental effects on trees compared with the alternative proposal without the set back.

Properties and the village of Coedpoeth

3.104 The Proposed Development design evolved to remove solar panels and include a landscape and biodiversity area to the north therefore reducing adverse impacts on residential amenity from nearby properties and the village of Coedpoeth. The implementation for this area, along with an landscape and biodiversity area directly north of the A525 west of Access 2, will also enhance habitat providing benefit to biodiversity in the area.

Barn Cottage to the east

3.105 The Proposed Development design evolved to remove solar panels from the field to the east in order to minimise visual impacts from Barn Cottage.

Connection to the legacy substation

3.106 Various cable route options have been explored and assessed in order to determine the preferred route to connect into the legacy substation south-west of the Site. Options have included routes along the A483, other existing roads and adjacent fields. Preferential options have sought to avoid or minimise impacts on:

- Plas Power Woods;
- Clywedog Valley Trail;
- Clywedog River;
- Trees and associated ecology features;
- Cultural heritage features, including Offa's Dyke Scheduled ancient monument; and
- Highway and traffic disruption.

3.107 Three route options were originally assessed and included:

- Cable Route Option 1: routing underground (via trench methods or horizontal directional drilling (HDD)) and following the unnamed road west past Cadwgyn Hall.
- Cable Route Option 2: routing underground through agricultural fields adjacent to the railway line from east to west.
- Cable Route Option 3: routing underground through agricultural fields to the south the railway line from east to west.

3.108 The three cable route options originally assessed are presented on **Plate 3.12** below.

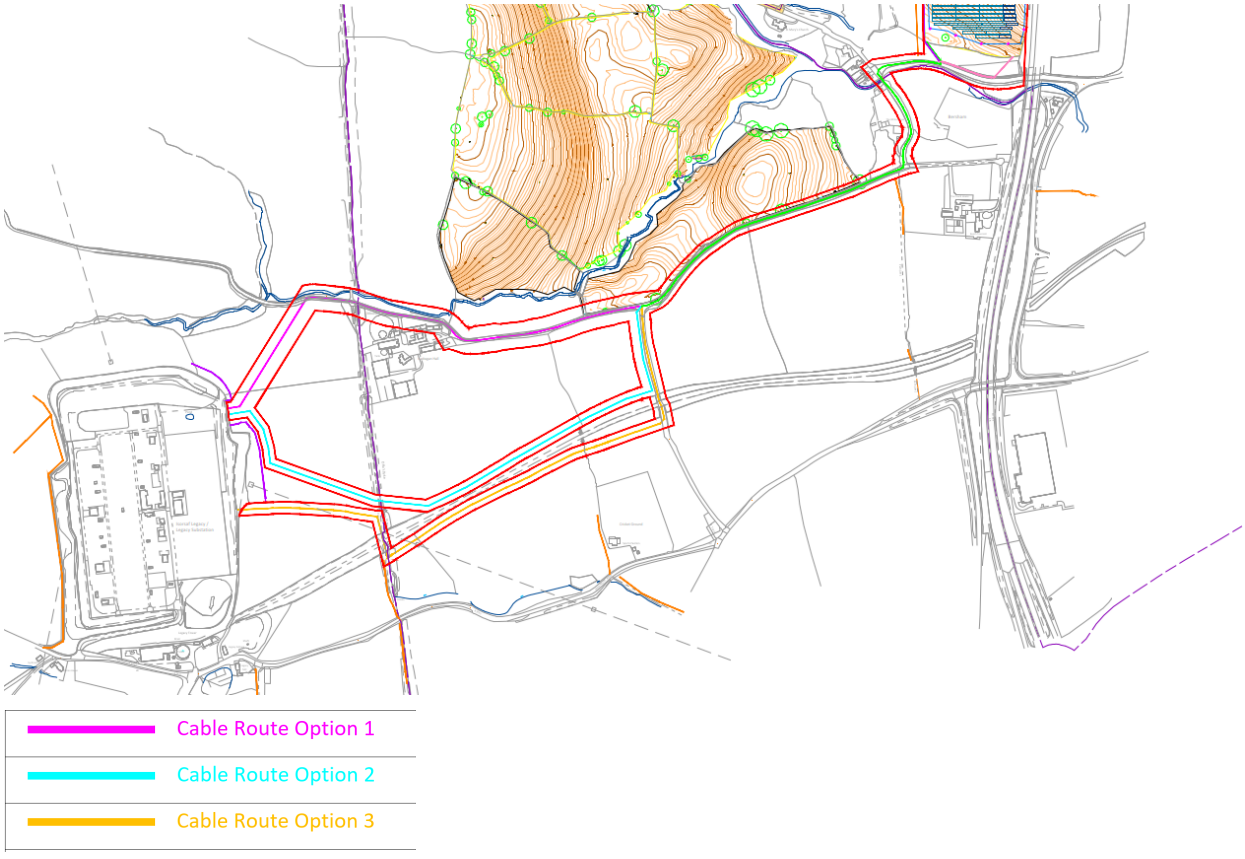


Plate 3.12: Illustrative Cable route Options (Option 1, 2 and 3)

3.109 Cable route options 2 and 3 were proposed to pass through the Offa's Dyke SAM. Initially, it was proposed that the cables would pass under Offa's Dyke by utilising HDD construction methodology. Liaison with CADW during the pre-application process confirmed the need for Scheduled Monument Consent (SMC) to be obtained for the works associated with option 2 and 3. In order to minimise the impact on Offa's Dyke SAM, options 2 and 3 were subsequently discounted and not taken forward.

3.110 Following this decision, consultation with National Grid was undertaken and it was determined that the connection to the legacy substation needed to be on the western side of the substation rather than to the east as designed. As a result, the design for cable route option 1 was amended to account for this requirement. Formally 'Option 1' but now presented in **Figure 2.2a** as the 'preferred cable route option' proposes to pass Offa's Dyke SAM via the unnamed road and therefore has the least impact to the SAM. Whilst this is the preferred route an alternative option 'Cable Route Option 1' was later developed which is largely the same as option 1 but is routed through fields to the south of unnamed road. The reason for this second option is to provide flexibility within the application for an alternative cable route in the event that there is conflict with existing or proposed utility infrastructure/ assets associated with the legacy substation in this particular location. This will only be confirmed once the design is further progressed.

3.111 Cable Route Option 2 and Cable Route Option 3 as show in **Figure 2.2a** provide a short alternative route to connect from Plas Buckley Road to the south of the site.

3.112 As a result, all options are assessed within this ES and are presented on **Figure 2.2a** of this ES. Further detail is also provided within **Chapter 2** of this ES.

Inclusion of BESS

3.113 As described in the 2023 Scoping Direction Request report, the option of including a BESS as part of the Proposed Development was a consideration but at that time the location had not yet been determined. This design iteration now includes the BESS which will be located to the south of the site, close to the infrastructure associated with the solar projects, and away from residential properties and sensitive viewpoints. The BESS allows for surplus energy generated at times of high production to be stored and dispatched to the grid at times when the energy is needed. The BESS therefore contributes to balancing the intermittent energy production and maximises the site's efficiency to allow a greater output of clean energy.

3.114 As stated in Chapter 2, the BESS is part of the Proposed Development and has therefore been assessed within the technical environmental assessments contained within this ES. However, the option for the Proposed Development to be constructed without the BESS is also feasible and therefore both options are being progressed and assessed as part of this application. If the BESS was not to be constructed, the land where the BESS is currently proposed would be used to place solar panels instead. **Figure 2.2b** (Drawing Number: LP2-PDL-S) illustrates the alternative layout should the BESS not be constructed, highlighting where the solar panels would be situated instead.

Current Layout

3.115 The current Proposed Development layout is provided in **Figure 2.2a** and **Figure 2.2b** of this ES and is largely the same as the fourth design iteration described above that was submitted as part of the pre-application consultation and takes on board all of the changes described above. Following the pre-application consultation, further development of the fourth design iteration were made. The changes made to the design were minor in nature but were implemented following feedback received during the pre-application consultation held between Wednesday 21st February and

Tuesday 9th April 2024. The changes made to the design of the Proposed Development are as follows:

- Increased landscape and visual screening proposed on the northern edge of the northern parcel between the Proposed Development fence line and the southern boundary of the residential property gardens that abut the Proposed Development. Following direct engagement with the residents during the pre-application consultation events it was determined that there may be some intervisibility between the Proposed Development and the southern end of the gardens in this location. This intervisibility was subsequently assessed by the landscape team and it was proposed to provide additional hedgerow in this location to help further screen the Proposed Development from these nearby residential receptors.
- Provision of an additional emergency access to the energy storage site has now been included in the design. This change was made to further comply with the National Fire Chiefs Council (NFCC) battery safety guidelines. Although the entire site has up to four site accesses (temporary and permanent) and complied with the requirement to provide two accesses it was felt that a second internal access to the energy storage site itself was necessary. The second access will only be used if the primary access to the energy storage site is unfeasible.
- Following a request from the Woodland Trust, some small tweaks to physical infrastructure were made to comply with a 25m buffer to separate any physical infrastructure (excluding security fencing for which a 15m buffer has been adopted) from all Ancient Woodland.
- Although not visible on **Figure 2.2a** and **Figure 2.2b**, an update to **Appendix 8.1: Flood Consequences Assessment (FCA) & Conceptual Drainage Strategy** has been carried out to include further clarification on how fire water will be managed in the unlikely event of a fire at the energy storage site. Further detail can be found within **Appendix 8.1** but to summarise, the drainage design associated with the energy storage site has allowed capacity for fire water to be captured and cycled for re-use in the event of a fire. This has been managed by lining and appropriately sizing the attenuation pond downstream of the energy storage site that will be controlled via a pen-stock valve. This will allow fire water to be captured and prevented from entering the local surface waterbodies and or groundwater if any form of contamination has occurred.

3.116 It should be noted that no change to the red line boundary occurred between design iteration 4 submitted with the pre-application consultation and the current design iteration contained within **Figure 2.2a**.

Site wide embedded mitigation measures

3.117 Throughout the EIA process the design of the Proposed Development has developed taking on board sensitive environmental receptors and feedback from the community consultation. The Design has inherently implemented a range of embedded mitigation measures to reduce and minimise impacts to the environment, examples include but are not limited to:

PRoW inclusion

3.118 The design has ensured accessibility throughout the site through the incorporation of PRoW routes within the Proposed Development.

3.119 PRoW routes have also been diverted along their current walked routes on the ground where this differed from the mapped route. An example of this is Bersham FP1 which is now proposed to follow

the alignment of the existing walked route through the site, the PRoW will also be screened with planting in order to reduce views of the Proposed Development for users of the PRoW.

Landscape and ecological enhancement

3.120 As detailed on the Illustrative Landscape and Ecology Masterplan (**Figure 5.10**) the Proposed Development has incorporated planting throughout the site including but not limited to:

- Internal and boundary hedgerow reinforcement;
- Woodland edge scrub planting adjacent to existing areas of established woodland;
- Structural woodland planting; and
- Meadow grassland mixes including tussocky grassland.

3.121 This will minimise potential landscape and visual impacts and maximise enhancement of landscape features, landscape character and the biodiversity of the site.

Ecological enhancement areas

3.122 Also detailed on the Illustrative Landscape and Ecology Masterplan (**Figure 5.10**) the Proposed Development has sensitively incorporated specific ecological enhancement areas into the design in order to maintain and enhance biodiversity through the retention of all higher value features and the creation of new habitats with value for wildlife. This includes but is not limited to:

- Creation of Biodiversity Enhancement Areas;
- Creation of a new pond in the Biodiversity Enhancement Area; and
- Further infill and additional planting along field boundaries and within Biodiversity Enhancement Areas.

Exclusion of panels in areas at risk of surface water flooding

3.123 The design has excluded solar panels in areas identified as being at risk of surface water flooding.

Exclusion of panels in Root Protection Zones (RPZ)

3.124 The design has accommodated the recommendations of Tree Protection Plan contained within the Tree Survey and Arboricultural Impact Assessment Report (**Appendix 5.8** of this ES).

Information boards

3.125 Information boards are proposed on site in locations close to the access points and the PRoW that run through site. The boards will contain information about the site, its history with the surrounding area, and the biodiversity on the site.

3.126 Whilst the current Proposed Development layout remains indicative, the key parameters of the Proposed Development have been identified and included as part of this assessment. Any future design evolution will remain within the parameters detailed in this ES, and therefore, the final detailed design will remain sufficiently assessed under the EIA process.

References

The Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017

Planning and Compulsory Purchase Act 2004

Welsh Government (WG) (2021) Future Wales: The National Plan 2040. [Available online at: gov.wales/sites/default/files/publications/2021-02/future-wales-the-national-plan-2040.pdf)

International Energy Agency (IEA) (2021) Net Zero 2050 – A Roadmap for the Global Energy Sector. [Available online at: Net Zero by 2050 – Analysis - IEA]

National Grid (NG) (2021) Future Energy Scenarios (FES). [Available online at: Future Energy Scenarios | ESO (nationalgrideso.com)]

Climate Change Act (2008)

Department for Business, Energy & Industrial Strategy (DBEIS) (2020) Energy white paper: Powering out net zero future. [Available online at: Energy white paper: Powering our net zero future - GOV.UK (www.gov.uk)]

4 ENVIRONMENTAL ASSESSMENT METHODOLOGY

Introduction

4.1 This chapter of the ES sets out the approach taken to the EIA of the Proposed Development. The chapter also includes details of the consultation undertaken to date and the overall approach to the assessment of the likely significant effects of the Proposed Development. Further details of topic specific methodologies, such as survey methods, are provided in each topic chapter of this ES.

Scoping

4.2 Scoping is the process of identifying the issues to be addressed during the EIA process. Scoping is an important preliminary procedure, which sets the context for the EIA process.

4.3 Regulation 33 of the EIA Regulations allows an applicant to request that PEDW sets out its opinion (known as a Scoping Direction) as to the issues to be addressed in the ES. Whilst there is no formal requirement in the EIA Regulations to seek a Scoping Direction prior to submission of an ES, it is recognised as best practice to do so.

4.4 A Scoping Request was submitted to the Planning Inspectorate (now PEDW) on 7 October 2020. The Scoping Report that comprised this request is included as **Appendix 4.1**.

4.5 The Planning Inspectorate (now PEDW) issued its Scoping Direction on 2 December 2020 and a copy of this is included as **Appendix 4.2**. In line with Regulation 33(7) of the EIA Regulations, the following statutory bodies provided formal responses to the Scoping Request submitted in October 2020:

- The relevant Local Planning Authority, Wrexham County Borough Council (WCBC))
- Natural Resources Wales (NRW)
- Cadw

4.6 Subsequently, and as set out in Chapter 3: Need and Alternatives Considered, the Proposed Development underwent significant iteration, and a revised Scoping Direction Request was submitted to PEDW on 5 June 2023. A copy of this is included as **Appendix 4.3**. In line with Regulation 33(7) of the EIA Regulations, the following statutory bodies provided formal responses:

- The relevant Local Planning Authority, WCBC
- NRW
- Cadw
- The Coal Authority
- The Welsh Ministers (i.e. Transport and Soil, Peatland & Agricultural Land Use Planning Directorates of the Welsh Government)
- The Health and Safety Executive (HSE)
- North Wales Fire and Rescue Service

4.7 The ES topic chapters provide a summary of the key points raised during Scoping and as a result of any further consultation with both statutory and non-statutory consultees.

4.8 The Scoping exercise also highlighted a number of areas that consultees wished to see addressed within the ES. Taking into account the nature, size and location of the Proposed Development, the

information provided within the Scoping Direction and other consultation responses provided so far throughout the EIA process, the following topics have been scoped in as requiring assessment within this ES:

- Chapter 5: Landscape and Visual
- Chapter 6: Biodiversity
- Chapter 7: Cultural Heritage
- Chapter 8: Hydrology and Hydrogeology
- Chapter 9: Climate Change
- Chapter 10: Soils

Climate Change Resilience

4.9 Resilience to future climate change has been considered during the design process. The design has taken into account, for example, future flood risk and resilience to extreme weather events. Further details are provided in Chapter 2: Proposed Development Description and Chapter 9: Climate Change.

Changes to Future Environmental Conditions

4.10 Consideration of predicted changes in baseline environmental conditions, including changes resulting from climate change, have been set out within each ES topic chapter, where robust information was available at the time of writing. Details are provided in the methodology section of this chapter.

4.11 The assessment of effects for each topic has taken into account identified trends or changes predicted to arise as a result of climate change.

Effects of the Project on Climate

4.12 Detailed assessment of the effects of the project on climate is set out in Chapter 9: Climate Change. The construction-stage impact due to the extraction of raw materials, manufacturing and transportation of the panels and associated electrical components is likely to have a minor adverse impact. The operational phase greenhouse gas effects, due to the generation of zero-carbon electricity and consequent displacement of marginal sources of generation with greater greenhouse gas impacts is likely to be considerable, and exceeds, policy goals for the rate of carbon reduction in the context of UK, Wales and Wrexham carbon budgets.

Topics Scoped Out of the EIA Process

4.13 Effects on other aspects of the environment are not likely to be significant. The topics scoped out of the assessment on this basis are set out in detail in section 4 of the Scoping Report(s) (**Appendix 4.1** and **Appendix 4.3**) and section 8 of the resultant Scoping Direction(s) (**Appendix 4.2** and **Appendix 4.4**) and are summarised below.

Planning Policy

4.14 The ES provides an overview of relevant legislative and planning policy context within each topic chapter and the assessments have had regard to national and local policy documents, where relevant. As explained in Chapter 2: Proposed Development Description, a separate chapter on

planning policy has not been included within the ES, however, a Planning Statement has been prepared to accompany the planning application.

Material Assets

4.15 The EIA Regulations refer to 'material assets', including architectural and archaeological heritage. The phrase 'material assets' has a broad scope, which may include assets of human or natural origin, valued for socio-economic or heritage reasons. Material assets are in practice considered across a range of topic areas within an ES, in particular the topic areas historic environment and socio-economics. These topics are included within this ES or have been scoped out as set out below. Therefore, no separate consideration of material assets is considered necessary. This approach was confirmed as acceptable in the Scoping Direction.

Population (Socio-economics), Human Health, Air Quality and Risk of Major Accidents

4.16 With regard to socio-economics, construction will have a temporary effect on employment provision through the creation of construction jobs however, it is unlikely that the Proposed Development will result in a significant change in population as workers are unlikely to relocate to the area on a permanent basis. Therefore, no significant effects are anticipated. The operational phase of the Proposed Development will not require permanent on site employment.

4.17 In terms of human health, the direct human health effects of the Proposed Development are limited. The Proposed Development will displace primary fossil fuel derived electricity and the consequent greenhouse gases and other pollutant emissions released during fossil fuel combustion and would likely result in a beneficial effect on human health.

4.18 In terms of air quality, the number of HGV movements during the construction of the Proposed Development will not exceed the traffic criteria detailed in the Institute of Air Quality Management (IAQM) (UK) Planning Guidance. As such the change in the volume of traffic on the surrounding road network will not have any significant effect on air quality as experienced by the nearest receptors located in the vicinity of the site. Additionally, a Construction Traffic Management Plan (CTMP), as outlined in the oCTMP (**Appendix 2.3**) will demonstrate that construction materials can be transported by environmentally friendly means; identify construction deliveries that could be reduced, re-timed or consolidated, particularly during peak periods; and encourage use of modern, low emission vehicles.

4.19 Solar photovoltaic technology is a relatively benign form of electricity generation with very low risk of accident or disaster and will not have a significant environmental effect in this regard. The Proposed Development will be enclosed by appropriately designed security fencing and monitored by CCTV, which will lower the risk of unauthorised access and accidents.

4.20 In response to potential risk associated with the BESS, an outline BSMP has been prepared and is included at **Appendix 2.1** of this ES. The BSMP provides a preliminary safety hazard identification and analysis, based on like for like energy storage systems of this type, namely Lithium-Ion Battery technology, and determines the likely causes and hazards associated with BESS technology of this type to enable the initial identification of potential control measures that when implemented will ameliorate the level of risk posed to an acceptable level.

4.21 Therefore, no separate consideration of population, human health, air quality or risk of major accidents is considered necessary. This approach was confirmed as acceptable in the Scoping Direction.

Transport

4.22 The site working hours will be 0700-1900 Monday to Friday and 0700-1300 Saturday. The first/last working hours would principally be for site mobilisation/demobilisation at the start and end of the working day. Noisy activities such as piling will be undertaken 08:00 to 18:00 hours Monday to Friday and 08:00 to 13:00 hours on Saturday. Should work need to be undertaken outside of these hours the contractor will obtain permission from the LPA prior to the works taking place.

4.23 The construction works may require around 1,200 HGV movements across the course of the construction programmes for both the solar installation and the subsequent BESS installation. Based on a 12-month construction programme and 5.5 day working week this would equate to around 4-5 HGVs (8-10 movements) per day. However, it is recognised that a flat profile across the programme is unlikely and there will be peaks in activity associated with overlaps in the construction programme and more transport intensive activities taking place. Therefore, the following peaks in HGV and LGV movements have been identified:

- HGVs (Daily Peak): 15 (30 movements)
- LGVs (Daily Peak): 4-6 (8-12 movements)

4.24 In order to reduce disruption to the road network as a result of the construction of the Proposed Development as far as practicable, an oCTMP has been produced and is included at **Appendix 2.3** of this ES. The oCTMP sets out detailed measures to manage construction traffic accessing the site in order to reduce any potential adverse impact as a result of the construction of the Proposed Development. Vehicle movements associated with the operation of the Proposed Development are negligible and will not result in any increase on existing traffic flows on the local road network.

4.25 The 2023 Scoping Direction issued by PEDW confirms that no concerns were raised by the Transport Directorate of WG subject to the scope of the CTMP being agreed with the Development Control Team so that there is no negative impact on junction 4 of the A483 during construction and decommissioning and that matters relating to glint and glare as well as cable crossings are considered. The Scoping Direction therefore concluded that transport can be scoped out of the ES.

4.26 Transport is therefore scoped out of the ES in accordance with the Scoping Direction.

Agricultural Land Classification

4.27 A detailed ALC Survey Report of the site has been undertaken to identify the distribution of ALC grades across the site and is included at **Appendix 10.2** of this ES. In accordance with WG guidance, the areas identified as Grade 3b agricultural land on the WG Predictive ALC Map have not been surveyed. This includes almost the entire southern portion of the site. The ALC Survey Report has therefore provided an assessment of the northern portion of the site as well as pockets of the southern portion of the site which were identified on the WG Predictive ALC Map as Grade 3a.

4.28 The ALC Survey Report confirms that the areas surveyed are variously limited by both wetness and droughtiness and that only 6.4% of the survey area (1.6 ha) contains Grade 3a agricultural land. The wider survey area contains 83.7% (21.5ha) Grade 3b and 7.9% (2 ha) Grade 4 agricultural land.

4.29 The ALC Survey Report has been independently verified by the WG LQAS. In respect of the 1.6 ha of Grade 3a agricultural land which is contained within the site, LQAS confirmed that is does consider the loss of 1.6Ha of BMV land to be '*a matter in the national agricultural interest*' and that it would be a matter for the Determining Authority to take a view regarding compliance with PPW 3.58 and 3.59 in the light of evidence before them.

4.30 Subsequently, this 1.6 ha area of BMV agricultural land has been removed from the site boundary and therefore there is no BMV agricultural land included within the site. In this respect, LQAS agreed in its consultation response contained within the 2023 Scoping Direction that ALC could be scoped out of the ES.

4.31 Notwithstanding the above, LQAS confirmed in its consultation response contained within the 2023 Scoping Direction that potential impacts on soil function during installation and decommissioning should be scoped into the ES. Accordingly, Chapter 10: Soils provides an assessment of the impact of the Proposed Development on soil function.

Land

4.32 The site is within an identified Mineral Resource Area, with the geology underlying the majority of the site containing a cover of Glacial Superficial deposits of either Glacial Till or Glaciofluvial sands and gravels overlying bedrock strata of the Pennine Lower and Middle Coal Measures. Whilst these deposits are present, they are recorded to extend significantly beyond the site boundary.

4.33 The presence of shallow coal seems has resulted in the use of much of the site, particularly to the east and south for opencast extraction. Subsequently, the site was restored with a non-water fill in 1976. A Desktop Survey (DTS) and Preliminary Risk Assessment (PRA) has assessed the historic working of the site and existing ground conditions. The DTS and PRA are included at **Appendix 4.6** in Volume 2 of this ES.

4.34 In respect of minerals resource, the site lies within an area designated for protection of sand and gravel reserves in the LDP. As such, a Coal Mining Risk Assessment (CMRA) and Minerals Resource Assessment (MRA) have been undertaken and are included at **Appendix 4.8**. The MRA confirms that there are minimal sand and gravel reserves present that would be economically viable to extract and that in the vicinity of the site, the sand and gravel reserves are associated with lenses and layers of Glacial Till which will result in significant overburden removal and also variability in quality of the sand and gravel reserves. Furthermore, given the temporary nature of the development, unlike permanent development, the development will not sterilise reserves or hinder extraction in the future as technology changes.

4.35 In terms of coal mining risk, the CMRA undertaken has identified no significant risks to the Proposed Development from historical underground mining or mine entries associated with underground mining. It confirms that the extent of former opencast workings may represent localised areas of poorly compacted backfilled pits and also represent a constraint to foundations or heavily loaded infrastructure. Specifically in the areas of more heavily loaded or enclosed structures further investigation is recommended to determine the depth and nature of backfill of opencast workings and provide geotechnical information in support of design of foundations/anchors. Further investigation will be undertaken to inform construction techniques at detailed design stage, prior to construction.

4.36 As such, land (both construction and operational) is scoped out of this ES.

Noise and Vibration

4.37 A Noise Survey Assessment has been undertaken for the Proposed Development and is included at **Appendix 4.5**.

4.38 The Noise Survey Assessment confirms that the baseline sound environment is generally quiet and dominated primarily by traffic on Ruthin Road (A525) and the surrounding local highway networks at the northern parcel and dominated primarily by traffic on the A483 in the southern parcel.

4.39 The nearest noise sensitive receptors to the Proposed Development are residential dwellings, specifically:

- Barn Hill Cottage
- Bersham Bank
- Bersham Lodge
- Bryn Moel
- Bwthyn Coctel
- Higher Berse Farm
- Lower Berse Farm
- The Bungalow
- The Dolls House
- The Meadows
- The Oaks
- Ty Newydd

4.40 The primary operational noise sources associated with the Proposed Development are the solar panel inverters, transformers, and substations as well as the BESS units, PCS inverters and PCS MV transformers. These sources do not generate any substantial levels of vibration since this is controlled at source as part of the plant design.

4.41 In order to reduce the noise impact experienced by the above receptors to an acceptable level, the Noise Survey Assessment has recommended specific mitigation measures in the form of plant selection, localised acoustic screening, acoustic enclosures, and enhanced casing around the units to minimise noise egress. The recommended mitigation measures have been incorporated within the design of the Proposed Development and it is demonstrated in the Noise Survey Assessment that with the inclusion of these measures, noise levels at receptors are reduced such that adverse impacts are sufficiently minimised and significant adverse impacts are avoided.

4.42 Noise and vibration during the construction and decommissioning phases are assumed to be similar and will be controlled via the detailed CEMP and application of Best Practicable Means (BPM). As such, it is unlikely that construction noise and vibration will give rise to significant effects at nearby receptors. Assessment of the noise and vibration impacts of the Proposed Development during construction and decommissioning has also been scoped out of this ES. Given separation distances from receptors, anticipated timings and anticipated construction noise levels, assessment of transboundary effects is also scoped out of this ES.

Transboundary Effects

4.43 For the topics scoped into this EIA (i.e. Landscape and Visual (Chapter 5), Biodiversity (Chapter 6), Cultural Heritage (Chapter 7), Hydrology and Hydrogeology (Chapter 8), Climate Change (Chapter 9) and Soils (Chapter 10)) transboundary effects are scoped out of the assessment as there are no likely significant effects on the environment of another European Economic Area (EEA) state.

Environmental Assessment Methodology

Relevant EIA Guidance

4.44 The EIA process has taken into account relevant government or institute guidance, including:

- Welsh Office Circular 11/99: Environmental Impact Assessment;
- The Planning Inspectorate: Developments of National Significance, Appendix 3: Environmental Impact Assessment (2019);
- Ministry for Housing, Communities and Local Government (2019a) Planning Practice Guidance at http://planningguidance.planningportal.gov.uk;
- Department of the Environment, Transport and the Regions (DETR) (1997) Mitigation Measures in Environmental Statements. HMSO;
- Highways Agency et al. (2008) Design Manual for Roads and Bridges, Volume 11, Section 2, Part 5. HA 205/08;
- Institute of Environmental Management and Assessment (2004) Guidelines for Environmental Impact Assessment;
- Institute of Environmental Management and Assessment (2011) The State of Environmental Impact Assessment Practice in the UK. Special Report; and
- Institute of Environmental Management and Assessment (2015a) Environmental Impact Assessment Guide to Shaping Quality Development;
- Institute of Environmental Management and Assessment (2015b) Climate Change Resilience and Adaptation;
- Institute of Environmental Management and Assessment (2016) Guide to Delivering Quality Development;
- Institute of Environmental Management and Assessment (2017) Assessing Greenhouse Gas Emissions and Evaluating their Significance; and
- Institute of Environmental Management and Assessment (2017) Health in Environmental Impact Assessment: A Primer for a Proportional Approach.

4.45 Other topic specific legislation and good practice guidance will be drawn upon as necessary and is set out in the relevant topic chapters.

Key Elements of the General Approach

4.46 The assessment of each environmental topic forms a separate chapter of the ES. For each environmental topic, the following have been addressed:

- Methodology and assessment criteria;
- Description of the environmental baseline conditions;
- Measures adopted as part of the project, including mitigation and design measures that form part of the Proposed Development;
- Identification of likely effects and evaluation and assessment of the significance of identified effects, taking into account any measures designed to reduce or avoid environmental effects which form part of the Proposed Development;

- Identification of any further mitigation or monitoring measures envisaged to avoid, reduce and, if possible, remedy adverse effects (in addition to those measures that form part of the Proposed Development);
- Assessment of any cumulative effects with other developments planned in the area; and
- Assessment of any relevant inter-related effects between topics.

Methodology and Assessment Criteria

4.47 Each topic chapter provides details of the methodology for baseline data collection and the approach to the assessment of effects. Each environmental topic has been considered by a competent expert in that area, the professional qualifications and relevant project experience relevant to the technical specialists that have produced the assessments in this ES are provided within **Appendix 1.2**.

4.48 Each topic chapter defines the scope of the assessment within the methodology section, together with details of the study area, desk study and survey work undertaken and the approach to the assessment of effects. The identification and evaluation of effects have been based on the information set out in Chapter 2: Proposed Development Description of this ES, EIA good practice guidance documents and relevant topic-specific guidance where available.

Description of the Environmental Baseline Conditions (Including Future Baseline Conditions)

4.49 The existing and likely future environmental conditions in the absence of the Proposed Development are known as 'baseline conditions'. Each topic chapter includes a description of the current (baseline) environmental conditions. The baseline conditions at the site and within the study area form the basis of the assessment, enabling the likely significant effects to be identified through a comparison with the baseline conditions.

4.50 The baseline for the assessment of environmental effects is primarily drawn from existing conditions during the main period of the EIA work in the period 2020 to 2023.

4.51 The baseline for the assessment should represent the conditions that will exist in the absence of the Proposed Development at the time that the project is likely to be implemented. The anticipated start date for construction (including enabling works) at Plas Power Solar and Battery Project is 2025. The programme would be of approximately 12-18 months duration (including enabling works) with an additional 6-9 months for the construction of the BESS prior to operation of the BESS in 2030. The assessment of construction effects which has been undertaken in each topic chapter assumes two independent construction periods for each element of the Proposed Development. Mitigation measures and recommendations for the construction period apply to both construction periods. Full operation of the site has been assumed to take place in 2026 (and 2030 for the BESS element). Further information about the construction programme assessed as part of the EIA process can be found in Chapter 2: Proposed Development Description of this ES.

4.52 Consideration has been given to any likely changes between the time of survey and the future baseline for the construction of the Proposed Development from 2024 and for operation of the Proposed Development from 2026. In some cases, these changes may include the construction or operation of other planned developments in the area. Where such developments are built and operational at the time of writing and data collection, these have been considered to form part of the baseline environment. Where sufficient and robust information is available, such as expected traffic growth figures, other future developments have been considered as part of the future baseline conditions. In all other cases, planned future developments are considered within the assessment of cumulative effects.

4.53 The consideration of future baseline conditions has also taken into account the likely effects of climate change, as far as these are known at the time of writing. This has been based on information available from the UK Climate Projections project (UKCP18), which provides information on plausible changes in climate for the UK (Environment Agency and Met Office, 2018) and on published documents such as the UK Climate Change Risk Assessment 2017 (Committee on Climate Change, 2016).

4.54 Potential climatic conditions in the 2040-2069 and 2070-2099 time periods at the site have been considered based on the Met Office Hadley Centre 'UKCP18' probabilistic projections (MOHC, 2021). Projections for the global emissions representative concentration pathways have been applied as applicable on a topic-by-topic basis.

Limitations of the Assessment

4.55 Each topic chapter identifies any limitations identified in the available baseline data and whether there were any difficulties encountered in compiling the information required.

Mitigation Measures Adopted as Part of the Project

4.56 During the EIA process, environmental issues have been taken into account as part of an ongoing iterative design process. The process of EIA has therefore been used as a means of informing the design.

4.57 The Proposed Development assessed within this ES therefore includes a range of measures that have been designed to reduce or prevent significant adverse effects arising. In some cases, these measures may result in enhancement of environmental conditions. The assessment of effects has taken into account measures that form part of the Proposed Development.

4.58 The topic chapters set out the measures that form part of the Proposed Development and that have been taken into account in the assessment of effects for that topic. These include:

- Measures included as part of the design (sometimes referred to as primary mitigation);
- Measures to be adopted during construction and operation to avoid and minimise environmental effects, such as pollution control measures. These measures would be implemented through the oCEMP and oCTMP (see **Appendix 2.2 and Appendix 2.3**); and
- Measures required as a result of legislative requirements.

Assessment of Effects

4.59 The EIA Regulations require the assessment of the likely significant environmental effects of the Proposed Development. This includes consideration of the likely effects during the construction, operational and decommissioning phases. The assessment is based on consideration of the likely magnitude of the predicted impact and the sensitivity of the affected receptor. The process by which effects have been identified and their significance evaluated is set out within each individual topic chapter. The overarching principles are set out below.

Sensitivity or Importance of Receptors

4.60 Receptors are defined as the physical or biological resource or user group that would be affected by a Proposed Development. For each topic, baseline studies have informed the identification of potential environmental receptors. Some receptors will be more sensitive to certain environmental

effects than others. The sensitivity or value of a receptor may depend, for example, on its frequency, extent of occurrence or conservation status at an international, national, regional or local level.

4.61 Sensitivity is defined within each ES topic chapter and takes into account factors including:

- Vulnerability of the receptor;
- Recoverability of the receptor; and
- Value/importance of the receptor.

4.62 Sensitivity is generally described using the following scale:

- High;
- Medium;
- Low; and
- Negligible.

4.63 In some cases, a further category of very high has been used.

Magnitude of Impact

4.64 Impacts are defined as the physical changes to the environment attributable to the Proposed Development. For each topic, the likely environmental impacts have been identified. For each topic the likely environmental changes arising from the Proposed Development have been identified and compared with the baseline (the situation without the Proposed Development). Impacts are divided into those occurring during the construction, operational and decommissioning phases.

4.65 The categorisation of the magnitude of impact is topic-specific but generally takes into account factors such as:

- Extent;
- Duration;
- Frequency; and
- Reversibility.

4.66 With respect to the duration of impacts, the following has been used as a guide within this assessment, unless defined separately within the topic assessments:

- Short term: A period of months, up to one year
- Medium term: A period of more than one year, up to five years; and
- Long term: A period of greater than five years.

4.67 The magnitude of an impact has generally been defined used the following scale:

- High;
- Medium;
- Low; and
- Negligible.

4.68 In some cases, a further category of ‘no change’ has been used.

Significance of Effects

4.69 Effect is the term used to express the consequence of an impact (expressed as the 'significance of effect'). This is identified by considering the magnitude of the impact and the sensitivity or value of the receptor.

4.70 The magnitude of an impact does not directly translate into significance of effect. For example, a significant effect may arise as a result of a relatively modest impact on a resource of national value, or a large impact on a resource of local value. In broad terms, therefore, the significance of the effect can depend on both the impact magnitude and the sensitivity or importance of the receptor.

4.71 Significance levels are defined separately for each topic. Unless separately defined in the topic chapters, the assessments take into account relevant topic specific guidance, based on the following scale and guidance:

- **Substantial**: Only adverse effects are normally assigned this level of significance. They represent key factors in the decision-making process with regard to planning consent. These effects are generally, but not exclusively, associated with sites or features of international, national or regional importance that are likely to suffer the most damaging impact and loss of resource integrity;
- **Major**: These beneficial or adverse effects are considered to be very important considerations and are likely to be material in the decision-making process;
- **Moderate**: These beneficial or adverse effects may be important, but are not likely to be key decision-making factors. The cumulative effects of such factors may influence decision making if they lead to an increase in the overall adverse effect on a particular resource or receptor;
- **Minor**: These beneficial or adverse effects may be raised as local factors. They are unlikely to be critical in the decision-making process, but are important in enhancing the subsequent design of the project; and
- **Negligible**: No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

4.72 The terms minor, moderate, major and substantial apply to either beneficial or adverse effects. Effects may also be categorised as direct or indirect, secondary, short, medium or long term, or permanent or temporary as appropriate.

4.73 Each chapter defines the approach taken to the assessment of significance. Unless set out otherwise within the chapter, topic chapters use the general approach set out in **Table 4.1**. For some topics, a simplified or quantitative approach is considered appropriate.

Table 4.1: Typical Assessment Matrix

Sensitivity	Magnitude of Impact				
	No Change	Negligible	Low	Medium	High
Negligible	No change	Negligible	Negligible or Minor	Negligible or Minor	Minor
Low	No change	Negligible or Minor	Negligible or Minor	Minor	Minor or Moderate
Medium	No change	Negligible or Minor	Minor	Moderate	Moderate or Major
High	No change	Minor	Minor or Moderate	Moderate or Major	Major or Substantial

Sensitivity	Magnitude of Impact				
	No Change	Negligible	Low	Medium	High
Very high	No change	Minor	Moderate or Major	Major or Substantial	Substantial

4.74 Unless set out otherwise in each topic chapter, effects assessed as moderate or above are considered to be significant in terms of the EIA Regulations within this assessment.

Further Mitigation and Future Monitoring

4.75 Where required, further mitigation measures have been identified within topic chapters. These are measures that could further prevent, reduce and, where possible, offset any adverse effects on the environment.

4.76 Where relevant and necessary, future monitoring measures have been set out within the topic chapters.

Assessment of Cumulative Effects

4.77 The EIA Regulations require consideration of cumulative effects, which are effects on a receptor that may arise when the Proposed Development is considered together with other proposed developments in the area.

4.78 The cumulative effects of the Proposed Development in conjunction with other proposed schemes have been considered within each topic chapter of the ES. For each topic chapter, a staged approach to the assessment of cumulative effects has been adopted as follows:

1. Stage 1: Establishing the long list – identifying the Zone of Influence (ZOI) applicable to the topic and undertaking a desktop review to identify the long list of approved development in the form of planning applications, or any other relevant development identified in Development Plans and any other available and relevant sources.

2. Stage 2: Establishing the short list – application of a threshold criteria relevant to that topic to establish a shortlist of other existing development and/or approved development.

3. Stage 3: Information gathering – information relating to proposed design and location, programmes of construction, operation and decommissioning and environmental assessments is reviewed. **Appendix 4.7** provides information relating to location and development proposed.

4. Stage 4: Assessment – the cumulative effects of the Proposed Development are assessed with the other developments identified in Stages 1-3 above. The cumulative assessment is undertaken in each topic chapter.

4.79 Other developments considered within the cumulative assessment include those that are:

- Tier 1 –
  - Under construction
  - Permitted, but not yet implemented
  - Submitted planning application, but the application is not yet determined
- Tier 2 –

  - Projects identified on the PEDW Planning Casework where a Scoping Report has been submitted.

- Tier 3 –

  - Projects identified on the PEDW Planning Casework where a Scoping Report has not been submitted.
  - Identified in the Development Plan (and emerging Development Plans - with appropriate weight being given as they move closer to adoption) recognising that much information on any relevant projects will be limited.
  - Identified in other plans and programmes (as appropriate) which set the framework for future development consents/approvals, where such development is reasonably likely to come forward.

4.80 It is noted that developments that are built and operational at the time of submission are considered to be part of the existing baseline conditions.

Interrelationships

4.81 Each topic chapter considers whether or not there are any inter-related effects with other topics included within the EIA or between different phases of the Proposed Development that have not already been considered in order to identify any secondary, cumulative or synergistic effects.

Summary Tables

4.82 Summary tables have been used to summarise the effects of the project for each environmental topic.

Consultation

4.83 Meetings have been undertaken throughout the EIA and design process to develop and/or agree methodologies and request and share information regarding existing environmental conditions. The project team has undertaken consultation with, or requested information from, a number of organisations, including, but not limited to, (with further details being provided in the relevant ES chapter):

- NRW (Chapter 5: Landscape and Visual)
- Clwydian Range and Dee Valley AONB (Chapter 5: Landscape and Visual)
- WCBC Arboriculture (Chapter 5: Landscape and Visual)
- NRW (Chapter 6: Biodiversity)
- WCBC Ecology (Chapter 6: Biodiversity)
- Clwyd-Powys Archaeological Trust (CPAT) (Chapter 7: Cultural Heritage)
- Cadw (Chapter 7: Cultural Heritage)
- WCBC Conservation Officer (Chapter 7: Cultural Heritage)
- WCBC Sustainable Drainage and Flooding (Chapter 8: Hydrology and Hydrogeology)
- Welsh Government Land Quality Advice Service (LQAS) (Chapter 10: Soils)

Local Planning Authority

4.84 The Proposed Development lies within the administrative area of WCBC. A pre-application consultation meeting was held with WCBC in December 2019 on the original proposals for the site. Following revision of the scheme, a further pre-application advice meeting was held with WCBC in March 2022 and then again in July 2023. During each pre-application advice meeting, a project update was provided followed by a discussion of policy implications together with a review of potential cumulative developments to be assessed in the ES. This ES has been informed by the pre-application advice received.

4.85 A meeting was held with the WCBC PRoW Officer on 2nd August 2023 to discuss the approach to accommodating the PRoWs within the Proposed Development.

4.86 Further to the above, topic specialists have consulted the relevant experts within WCBC and their consultees on their approach to the EIA through the Scoping process. Further information regarding consultation with topic specific organisations is detailed within the individual topic chapters.

Early Engagement

4.87 Key stakeholders including the ward councillors, community councils, local MS and local MP were sent an email on 2 May 2023 to introduce the project and invite them to have a one-to-one meeting at the start of the project. Stakeholder meetings were held with the local MS and two local ward councillors during May and June 2023; and followed up in September 2023.

Non-statutory Public Consultation

4.88 In addition to the statutorily required public consultation, the Applicant also undertook a period of non-statutory consultation on the emerging proposals between 12 June and 27 July 2023. A variety of consultation tools and communication channels were used to encourage participation in the consultation from stakeholders and the local community, including:

- Newsletter – a bilingual newsletter introducing the emerging proposals for the Proposed Development was posted on the 9 June 2023 to a total of 4837 properties in the defined consultation zone (approximately 2 mile radius of the site) and emailed/posted to identified stakeholders on the 12 June (including elected representatives, schools, community and interest groups) in the consultation zone and wider area.

- Website – A website was set up at the start of the project to provide information about the site, proposals, feedback mechanisms and contact details so local communities and stakeholders can find out more and comment on the emerging proposals: https://lightsourcebp.com/uk/project/plas-power/

- Consultation summary brochure – a consultation summary brochure was produced that included information about the proposals, details about the consultation including the website and feedback methods, a site map, key environmental considerations, wider benefits and social value and the project timeline. This was available on the website, as well as in hard copy at drop-in events, key community venues and to send to people with no digital access, to enable them to understand the project and respond to the early engagement.

- Press release – a press release was sent to local media to introduce the project and publicise the non-statutory consultation on 9 June 2023.

- Webinar – an online webinar held on Tuesday 20 June at 18:00. A total of nine people signed up to the webinar and five attended. The webinar involved a presentation from the project team about the project followed by a question and answers session. The presentation was pre-recorded and was uploaded onto the website after the event.

4.89 In addition to the above, the Applicant arranged four public exhibitions (see below).

4.90 The exhibitions were publicised by writing to the properties near the site. WCBC officers were also advised of them as were local councillors and the relevant Community/Parish Councils.

Public Exhibitions

4.91 Four public exhibitions were held over three days. Detail of these public exhibitions is contained within **Table 4.2** Below.

Table 4.2: Summary of Public Exhibitions

Date	Time	Venue	Attendees
Tuesday 26 July 2023	12:00 - 17:00	Plas Pentwyn Community Centre	60
Tuesday 26 July 2023	18:00-20:00	Brymbo Sports and Social Club	10
Wednesday 27 July 2023	09:00-13:00	Brymbo Sports and Social Club	7
Thursday 20 July 2023	14:30- 17:30	Rhostyllen Parish Hall	30

4.92 The key matters raised by attendees of the exhibition were:

- Support for the proposed development in respect of the need for greener energy and the need to meet renewable energy targets;
- The need for construction traffic to be appropriately managed;
- The need for existing PRoW networks to be retained and enhanced; and
- The potential for the applicant to establish a community benefit fund to fund local Community Council projects.

4.93 Further detail is provided in the Pre-Application Consultation (PAC) Report (see below).

Statutory Public Consultation

4.94 As part of the consultation process, the Applicant has engaged with the local community to inform local people about the Proposed Development, to explain its likely effects and to take on board any matters raised. A summary of the statutory pre-application public consultation carried out is set out below.

- Letters were issued to neighbouring properties and statutory consultees that set out the proposed development and how to comment on the proposals.
- The statutory consultation was also advertised in the local paper.
- As referred to in the letters, a website was set up for the Proposed Development.
- Site notices were also erected at locations around the site.

Pre-Application Consultation (PAC) Report

4.95 A PAC report has been submitted with the application providing details of all of the consultation undertaken, both statutory and non-statutory.

4.96 Comments received have been taken into account by the design team in the final preparation of the planning application and, where relevant, in the EIA process and/or other application documents. The PAC Report outlines where the matters have been considered and also explains whether certain matters were unable to be addressed and why.

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5 LANDSCAPE AND VISUAL IMPACT ASSESSMENT

Introduction

5.1 This chapter of the ES sets out the approach to the assessment of effects of the Proposed Development upon the landscape resources and visual receptors within the study area. It describes and addresses the existing landscape and visual resources within the site and the surrounding study area. This includes identification of the character and features of the landscape and assessment of the changes that would result as a consequence of the Proposed Development. In addition, it assesses the potential visual effects arising as a result of the Proposed Development. The chapter reports on studies (including a combination of field surveys and desktop research) to describe, classify, and evaluate the existing resources to form a basis for the assessment of any potential significant effects of the Proposed Development. This chapter also makes reference to the Glint and Glare Assessment completed for this application (**Appendix 5.1**).

5.2 The principal objectives of the assessment are:

- To describe, classify and evaluate the existing landscape likely to be affected by the Proposed Development during its construction and operational phases;
- To identify visual receptors with views of the Proposed Development; and
- To identify effects on landscape and views and assess their significance, taking into account measures proposed to reduce or avoid any effects identified.

Assessment Methodology

5.3 An outline of the methodology used for this assessment is given below, refer to **Appendix 5.2** for the full Assessment Methodology. Note that in this topic chapter, those effects of Moderate and below are **not** considered to be significant. Those effects to be Major and above **are** considered to be significant. The LVIA adopts a different methodology to that stated within Para 4.68 of this report.

Planning Policy Context

5.4 A full list of relevant planning policy for Plas Power Estate, from hereinafter referred to as the site, is included within **Appendix 5.3**.

National Planning Policy

5.5 Edition 12 of Planning Policy Wales (PPW) was published in February 2024 by Welsh Government, replacing all previous versions.

5.6 PPW sets out the land use planning policies of the Welsh Government. *"The primary objective of PPW is to ensure that the planning system contributes towards the delivery of sustainable development and improves the social, economic, environmental and cultural well-being of Wales".*

5.7 Further details of the information contained within the PPW of relevance is provided in **Appendix 5.3.**

Local Planning Policy

5.8 The following section describes the local policies that are considered to be relevant to this assessment chapter. Policies are included within **Appendix 5.3** and landscape designations are shown on **Figure 5.1**.

5.9 The site lies within the administrative area of WCBC. The current Development Plan for WCBC is the Wrexham Local Development Plan (LDP), adopted December 2023.

5.10 There are no formal national or international designations within the site itself. Part of an area of Ancient Woodland, of local importance, is located in the north of the site. The adopted Policies Map for WCBC (LDP) identifies the southern part of the site is as Green Wedge under Policy SP6.

5.11 Full details of policy's relevant to the site from the LDP are included within **Appendix 5.3**.

Designations

5.12 Within the 5km radius study area there are a number of landscape planning designations that have been reviewed.

5.13 The Clwydian Range and Dee Valley Area of Outstanding Natural Beauty (AONB), which is of national importance for scenic quality, is located 2km to the west (at its nearest point) of the site. Three Representative viewpoints have been selected to illustrate potential views from the AONB towards the site, including VP9, 10 and 11 (see **Figure 5.2**). The AONB consists of heather-clad peaks and iron age hillforts. Tir Mynedrid area of Registered Common Land is also located within the AONB at a distance of 2.2 km (at its closest point), from the site. The special qualities of the AONB have been reviewed and listed within paragraph 5.40.

5.14 Bersham Conservation Area is located to the south of the southern Parcel of the site. The Conservation Area encompasses an area to the north and south of the River Clywedog and Bersham Road, extending to the east of the A483. The Bersham Conservation Area Assessment and Management Plan (Adopted December 2009) details "*The influences of both the ironworks and the nearby Plas Power Estate are evident in the development of the village the architectural styles and features, which afford Bersham its unique character".*

5.15 There are a number of Listed Buildings within the study area (refer to Cultural Heritage Chapter 7 for further details). In close proximity and located within Bersham Conservation Area there are nineteen Buildings Listed (Grade II) that included: St Mary's Plas Power Church, Bersham Lodge, Bersham Mill and Caeau Bridge. Adjacent to the western site boundary (Southern Parcel) there are five Listed Buildings (Grade II) associated with the Plas Power Estate that include: Rhosberse Lodge, Stable Block, Bath House, Ice House and Game Larder. Also located to the west of the site is Plas Power Park Cottage and Rhosberse Lodge (both Grade II Listed), located to the east of Rhos Berse Road at a distance of 0.4km and 0.47km respectively from the site (at its closest point). The northern and eastern boundary of the Plas Power Estate are bound by a stone wall) and railings and gates (Grade II) at the entrances to Plas Park at West drive and West Entrance Drive. See policy EC9 **Appendix 5.3**).

5.16 Erddig Historic Park and Garden is located approximately 2km (at its closest point) to the east of the site. The Country House is a Listed Building (Grade I) dating back to the 17th Century, with its formal garden and landscaped parkland dating back to the 18th Century.

5.17 Offa's Dyke Scheduled Monument runs to the west of the site in a north to south direction and passes within the north-western corner of the Plas Power Estate to the west of the site. It passes circa 125m to the west of the main site. It passes circa 125m to the west of the main Proposed

Development site (at its closest point). The cable route passes through the Offas Dyke Schedule Monument to the southwest of the main Proposed Development site. Bersham Ironworks Scheduled Monument (Grade II) listed located within Bersham Conservation Area located 42 meters to the south of the Southern Parcel of the site and immediately adjacent to (although outwith) the preferred cable route option. The assessment of effects on the Scheduled Monument, Listed Buildings, Conservation Area and Historic Park and Garden are detailed in the Cultural Heritage Chapter 7.

5.18 There are also several areas of Ancient Woodland within the study area and adjacent to the site. A large area of Ancient Woodland is located along valley sides and banks of the River Clywedog and the Clywedog Trail runs through this woodland. There are a number of ecological designations including Sites of Special Scientific Interest (SSSI) and Special Area of Conservation (SAC) as below:

- River Dee and Stryt Las (SSSI) (approximately 1.9 km from Site)
- Ruabon/Llantysilio Mountains and Minera (SSSI) (approximately 8.1 km from Site)
- Johnstown Newt Sites (SAC) (approximately 1.9 km from Site)
- River Dee, Bala Lake and Berwyn a Mynyddoedd De Clwyd / Berwyn and South Clwyd Mountains (SAC) (approximately 7.1 km from Site)

5.19 Other designations shown on **Figure 5.1** but outside the 5km radius study area, include Historic Landscapes; RAMSAR site; and Pontcysyllte Aqueduct and Canal World Heritage Site. Given the distance to these designations from the site, they are not anticipated to be affected by the Proposed Development and therefore scoped out of the baseline or the assessment of effects.

Relevant Guidance

5.20 As a matter of best practice, this assessment has been undertaken based on the relevant guidance on landscape and visual impact assessment (LVIA) described in the following documents:

- Guidelines for Landscape and Visual Impact Assessment, 3rd Edition (GLVIA3) (Landscape Institute and Institute of Environmental Management & Assessment, 2013);
- Landscape Character Assessment Guidance for England and Scotland (The Countryside Agency and Scottish Natural Heritage, 2002);
- An Approach to Landscape Character Assessment (Natural England, 2014);
- Technical Guidance Note 06/19, Visual Representation of Development Proposals (Landscape Institute, September 2019):
- TGN 02-21: Assessing landscape value outside national designations.
- Using LANDMAP in Landscape and Visual Impact Assessments GN46 (Natural Resources Wales)
- Landscape and Visual Impact Assessment (PEDW April 2020)

Study Area

5.21 A 5 km radius study area had been used for this assessment despite its land cover due to the low height of the PV panels, at a maximum of 3m above ground level (AGL), and the BESS and proposed

substations are at a low height of 4.1m AGL. It is anticipated that any potential effects would be well within this radius.

5.22 In order to further determine available views, a computer-generated ZTV model was run and mapped. The ZTV can be defined as the theoretical area from which part of the Proposed Development would potentially be visible and broadly defines the study area for both the landscape character and visual assessment. The ZTV is illustrated on **Figure 5.2.** These illustrate the theoretical visual envelope for extent of the development at 3m (AGL). Although low areas of visibility extend beyond the 5km study area it is anticipated that no significant effects would be anticipated beyond the 5km study area.

Baseline Methodology

5.23 This LVIA has been based on the methodology in GLVIA3. The full Landscape and Visual Impact Assessment Methodology can be found in **Appendix 5.2**.

5.24 In order to undertake a complete assessment, several clear stages were identified and addressed with reference to the guidance in GLVIA3. In summary, the stages were as follows:

- Establishment of the study area;
- Desk studies;
- Field surveys;
- Consultation;
- Iterative design; and
- Assessment of significance of effects.

Consultation

5.25 **Table 5.1** sets out the consultation undertaken as part of the EIA process, relevant to the LVIA.

Table 5.1: Consultation Responses Relevant to this Chapter

Date	Consultee and Issues Raised	How / Where Addressed
May 2020	The Planning Inspectorate Pre-Application EIA Screening Direction Input request.	Accordingly, this EIA has been undertaken.
1st July 2020 Screening Direction Appendices	**The Planning Inspectorate** *It is likely the scheme would result in significant visual effects and an EIA is required.* **Natural Resources Wales**	Landscape and Visual Impact has been assessed in this ES.

Date	Consultee and Issues Raised	How / Where Addressed
	Footpaths and open access land within the vicinity of New Broughton (within the AONB) have the potential for views of the proposed solar farm. The greater than 1.5km viewing distance and panoramic nature of the view has the potential to make the solar farm a relatively small component of the view. The visual characteristics of the development are likely to have some contrast with farmland but would be seen quite closely associated with the settled and developed lowlands around the town of Wrexham.	Representative Viewpoints 10 and 11 are both located within the Clwydian Range and Dee Valley AONB. In addition, photomontages have been produced to represent views at winter year 1 and year 15 and are illustrated in **Figure 5.9**.
	From desktop context analysis, we consider the proposed development has the potential to have some adverse effect upon views from the AONB, but that the effects are unlikely to be significant. *We would expect a Landscape and Visual Assessment (LVA) to be undertaken and submitted with the planning application; the analysis of available views used to inform the layout of the scheme; and to identify any areas where strategic planting, thickening of hedgerows etc would benefit the development's visual integration. The AONB, local landscapes and local visual amenity interests need to be considered. A glint and glare assessment would also be required for viewpoints identified by the LVA.*	The Illustrative Landscape and Ecology Masterplan (**Figure 5.10**) has been developed to minimise visual impacts from the surrounding landscape and includes views from the AONB. As detailed above the photomontages illustrate the scheme at year 15 when on site planting has reached a high to provide screening effect. The Glint and Glare Assessment (**Appendix 5.1**) considers effects from the AONB.
	The Welsh Government Historic Environment Services (Cadw) *The proposed development is still likely to have an adverse impact on the settings of a number of the designated historic assets identified above and also on non-designated historic assets. Consequently any application for this development will need to be accompanied by a desk-based historic environment assessment including information on the scale of these impacts.*	This has been addressed within Chapter 7: Cultural Heritage.
	Wrexham County Borough Council *Parts of the site falls within a Green Wedge under policy SP6.* *The site is within Wrexham LANDMAP areas 7c, 7d and 9a (appendix B).* *The key priority is the conservation and enhancement of the landscape. LDP Policy SP6 does not explicitly refer to renewable energy, however the key consideration for this type of development will be demonstrating that the proposals have been designed to minimise visual impact from both near and distinct viewpoints.*	WCBC's comments have been taken into consideration and the Green Wedge and SLA form part of the baseline. Landscape relevant policies from the emerging local plan have been referenced within Planning Policy (Appendix 2). Wrexham LANDMAP LCAs have been referenced within the baseline study and landscape character effects have been assessed during construction and Operation - Year 1 and year 15.

Date	Consultee and Issues Raised	How / Where Addressed
	The development will inevitably result in a significant change to the existing landscape. Whilst I am confident that there are areas of the land where the development would not be unduly prominent, parts of the land are particularly visible, included those areas immediately to the north and south of the A525, the B5430 and Tanllan Lane. I am concerned that due to the longer distance views possible of the land from these roads, parts the development would be highly visible and therefore harmful to the landscape. This is matter that would need to be given further detailed consideration. Whilst the site is some distance from the Clwydian Range and Dee Valley Area of Outstanding Natural Beauty, it will also be necessary to consider the impact upon via long distance viewpoints. Taking all of the above into account, the final design of the development will need to be informed by a Landscape and Visual Impact Assessment. Opportunities for landscape enhancements to help integrate the development into the wider rural landscape will also need to considered.	Potential effects on visual amenity for various receptor groups have been taken into account during construction and Operation - Year 1 and year 15, and includes views from the road and from within the AONB (Viewpoints 10 and 11). The Illustrative Landscape and Ecology Masterplan (**Figure 5.10**) has been informed by the LVIA and ecological proposals.
	Consultation is required with Natural Resources Wales.	Consultation was undertaken with NRW on the 8th.September 2023 – see below.
	The development would be designed to minimise the loss of trees and hedgerows. I would expect an Arboricultural Impact Assessment to be undertaken prior to the layout of the development being finalised.	Please refer to Plas Power Solar Farm Arboricultural Impact Assessment JSL3859_770 (October 2023) (**Appendix 5.8**).
22nd December 2020	**The Planning Inspectorate Scoping Direction** *ID 5.13 Glint and Glare* *The applicant should ensure that any impacts on the Clwydian Range and Dee Valley Area of Outstanding Natural Beauty (AONB) are considered in the assessment. Please note the comments from NRW in their consultation response. Glint and Glare should also be considered as part of the assessment of impacts on the Historic Environment.*	Representative viewpoints 10 and 11 are both located within the Clwydian Range and Dee Valley AONB. In addition, photomontages have been produced to represent views at winter year 1 and year 15 and are illustrated in **Figure 5.9**. Chapter 7: Cultural Heritage has assessed the impact of the Proposed Development on the historic environment.

Date	Consultee and Issues Raised	How / Where Addressed
16th November 2020	**Natural Resources Wales** *The proposed development lies approximately 1.7km to the east of the Clwydian Range and Dee Valley Area of Outstanding Natural Beauty (AONB). We have reviewed Chapter 5 (Landscape and visual, section 5.10 – 5.47) which discusses the landscape assessments proposed.* *The development site is located on lower ground within an area of farmland that contributes to the rural setting of the town of Wrexham. The A483 physically contains Wrexham and has stopped the town's urban expansion westwards and from merging with adjacent urban villages. The development of this site, if approved, would bring about a major development within open countryside, the implications of which are to alter the openness and rural nature of a large area of land, for the lifetime of the development. During the lifetime of the development the Wrexham Local Development Plan is likely to be reviewed and new areas for housing provision planned. It is our experience that once development becomes an established characteristic (even if it can be argued that it is temporary and can be removed) it can influence strategic planning decisions about future patterns of growth.* *In regard to the AONB, we therefore advise that the Landscape and Visual Impact Assessment (LVIA) confirm whether the visual appearance of the development would cause a sense of urban encroachment towards the AONB and what mitigation could be applied to avoid this.*	This has been considered for Representative Viewpoints 9, 10 and 11 that are located within the Clwydian Range and Dee Valley AONB. Additional assessment has been completed for the potential effects upon the AONB in consideration of the sense of urban encroachment within the cumulative assessment and the conclusions at paragraph 5.258.
	We agree to the assessment of candidate views 15 and 16 from the AONB. *We note that a Glint and Glare assessment will be undertaken. We advise that this assessment should explain whether or not AONB viewpoints would be affected and why this has been assessed to be the case. In our experience Glint and Glare assessments can be too generic.*	**Candidate viewpoints 15 and 16 are now Representative Viewpoints 10 and 11.** Further detail is included in Assessment section. The Glint and Glare assessment was undertaken by Pager Power with the request for the Representative Viewpoints to be assessed. Additional analysis has then been undertaken for the views from within the AONB, so this is therefore not a generic approach.

Date	Consultee and Issues Raised	How / Where Addressed
	Where candidate viewpoints are shown to be affected, we would expect the LVIA to present an assessment of the worst-case glint and glare visual effect. The visual descriptors set out in Table 8.3 Example Definitions of Magnitude, do not fully capture this type of visual intrusion. Due to the eye-catching nature of reflected light, we would expect a glint or glare occurrence to result in a high magnitude of change, unless otherwise explained.	Additional text included into the methodology as a factor for consideration under Size or Scale for making a judgement on Magnitude of Change as follows; *"Our judgement would also take into consideration the potential for, and duration of, solar reflection."*
8th September 2023	**Natural Resources Wales - Landscape and Ecology Meeting** • *NRW confirmed that NRW's interest is solely concerned on designated landscapes, and therefore the visual impact of the proposed development on the AONB.* • *NRW confirmed that NRW would expect the height of vegetation (hedgerows) to be managed at a greater height than it is currently managed by the farmer/landowner . It was confirmed that NRW would expect the DNS application documents to specify this height.* • *RPS confirmed that ancillary infrastructure would be set-back by at least 15m from the woodland. NRW agreed that this is an acceptable set-back.* • *NRW advised that the LVIA should consider NRW GN46 guidance in respect of the use of LANDMAP.*	Natural Resources Wales comments have been taken on board and informed the Illustrative Landscape and Ecology Masterplan (**Figure 5.10**). Use of LANDMAP in Landscape and Visual Impact Assessments GN46 has been referred to (paragrah 5.24)

Date	Consultee and Issues Raised	How / Where Addressed
17th October 2023	**PEDW Scoping Opinion** *Landscape and Visual* *NRW welcome the confirmation that the Landscape and Visual Impact Assessment (LVIA) will assess the potential effects on the Clwydian Range and Dee Valley Area of Outstanding Natural Beauty. The Applicant's attention is drawn to their comments regarding the evidence which should inform the assessment, viewpoints and photomontages. NRW advises that the listed guidelines upon which the LVIA would be based should refer to NRW GN46 (Using LANDMAP in Landscape and Visual Impact Assessments).*	Use of LANDMAP in Landscape and Visual Impact Assessments GN46 has been referred to (paragraph 5.24). Paragraphs 5.112 – 5.115 set out the evidence which has informed the assessment of Representative Viewpoints.
April 2024	**NRW Response to Statutory Pre-Application Consultation** NRW question whether the magnitude of change for VP 10 and 11 would reduce to negligible given that photomontages do not show significant difference in visibility between Year 1 Winter and Year 15 Summer. NRW advise planting should be included along the western edge of parcels A and B, which appear to be visible from within the AONB. NRW question whether the effects on visual receptors within the AONB would reduce to negligible by Year 15 in the summer as predicted in the LVIA. NRW request: - inclusion of high resolution copies of photomontages from VPs 10 and 11. - Identification and explanation of the mitigation/ integration planting proposed in response to views from the AONB and the adverse impacts identified on receptors within AONB. - Confirmation is provided as to whether planting is proposed along the western edge of parcels A and B.	ES Volume 2 – Figures 5.1 – 5.10 – high resolution images included. The high-resolution montages illustrate that whilst at year 15 views of the solar panels would still be obtained the establishment of the planting provide additional filtering of views of the Proposed Development making views less visually prominent within the landscape. From the AONB, solar panels located in the western portion of the Proposed Development are largely out of view due to the landform. Fields located in the middle section of the Proposed Development would obtain the greatest level of screening in views from the AONB with small parts of these fields being screened from view. This would reduce the overall amount of solar development within the view. The establishment of the onsite planting would slightly reduce the overall level of perception of the Proposed Development within the landscape and subsequently the level of effect would be reduced. Fields (parcels) A and B are low lying and partially feature within views obtained from the AONB – field references have been added to the baseline photomontage photography. Existing hedgerows are located along the western boundary of fields A (to the east of the redline boundary) and B (to the west of the redline boundary) and these would be enhanced and include additional hedgerow tree planting to improve their screening potential. The magnitude of impacts on visual receptors within the ANOB is considered to be Negligible at year 15 and lower that at year 1 due to the establishment of the scheme planting would provide additional filtering of views of the Proposed Development making views of the solar panels less visually prominent within the landscape. High sensitivity visual

Date	Consultee and Issues Raised	How / Where Addressed
		receptors experiencing a Negligible magnitude of impacts would result in Minor adverse effects at year 15.

Limitations of the Assessment

5.26 The visual assessment is based on analysis of views towards the site and includes viewpoints in sensitive locations from which the Proposed Development would be most visible, not all public viewpoints from which the development would potentially be seen have been included in the assessment.

5.27 The information provided in this chapter is considered appropriate to allow a robust assessment of the likely landscape and visual effects of the Proposed Development to be made.

5.28 The visual assessment and associated field work have been carried out during winter 2021 when deciduous trees were not in full leaf. As such, professional judgement has been used regarding the summer situation. Additional site work was completed in winter and summer 2022/2023 as part of the Residential Visual Amenity Assessment (**Appendix 5.7**).

Baseline Environment

Overview of the Study Area & Site

Site and Local Surrounds

5.29 The fields that form the site have been given a reference letter for identification purposes within this assessment, shown in **Figure 5.3** Site Location and Field References.

5.30 The study area is located in the north-east of Wales, adjacent to English border. The urban area of Wrexham is located in the north-east with smaller settlements of Rhoslyllen, Coedpoeth, Brynteg and Gwersyllt located in the surrounding agricultural landscape to the south-west. The Esclusham Mountains, are located in the south-western extents of the study area and form a significant undeveloped area beyond the extents of the study area.

5.31 The site is located approximately 2.5 km to the west of Wrexham City Centre and to the to the west of the A483. It comprises two areas, which will be referred to as the Southern Parcel with associated construction access route (Fields A-R but excluding Field D as this field has been removed from the scheme) and the Northern Parcel (Fields S-V). The A525 Ruthin Road runs between the two land parcels that form the site for the solar panels. The associated underground cable route runs to the south of the Southern Parcel.

5.32 The Southern Parcel falls within the Plas Power Estate and comprises of a large area of made ground that was formerly used for opencast mining, now under pastoral use and divided into regular medium sized fields. Land associated with Home Farm includes an area of woodland, fields and small number of individual residential properties which lie to the north, beyond which is the A525. The A483 runs adjacent to the east. Plas Power Woods bounds the south of the Southern Parcel and follows along the course of the River Clywedog. Agricultural fields are located to the west, beyond which lies Rhos Berse Road and Perygeli Road. The Southern Parcel is accessed via the A525 Ruthin Road.

5.33 The Northern Parcel comprises of agricultural fields that are bound to the north by agricultural fields, beyond which lies Tan Lian (road) and the B5340. To the east lie more agricultural fields with Heritage Way (road) located beyond. Farm outbuildings associated land and the A525 is located to the south and the residential area of Coedpoeth lies to the west beyond a small area of agricultural fields that contain two pylons and overhead powerlines.

5.34 Both land parcels that form the site consist of several agricultural fields primarily used for intensive pasture grazing in the south (Southern Parcel) and arable crop in the north (Northern Parcel). The agricultural fields that form the Southern Parcel are segregated by a mixture of post and wire fencing, hedgerows and tracks. An area of mixed woodland is located in the north with an area of standing water/attenuation basin located within the southern confines of this woodland. A Public Right of Way (BER/1) runs north to south through the middle of this part of the site. The agricultural fields that form the Northern Parcel are segregated by hedgerows containing individual trees. A Public Right of Way (BER/8) runs north to south in the east of this this part of the site.

Designations

5.35 Within the 5km radius study area there are a number of landscape planning designations that have been reviewed.

5.36 The Clwydian Range and Dee Valley Area of Outstanding Natural Beauty (AONB), which is of national importance for scenic quality, is located 2km to the west (at its nearest point) of the site. Three Representative viewpoints have been selected to illustrate potential views from the AONB towards the site, including VP9, 10 and 11 (see **Figure 5.2**). The AONB consists of heather-clad peaks and iron age hillforts. Tir Mynedrid area of Registered Common Land is also located within the AONB at a distance of 2.2 km (at its closest point), from the site. Table 1 within the Clwydian Range and Dee Valley AONB Management Plan 2014 – 2019 lists the Special Qualities of the AONB. Those of relevance to this assessment are as follows (abridged):

Landscape Quality and Character Tranquillity

Tranquillity is associated with an atmosphere of calm and stillness; peace and quiet; and with dark night skies.

Remoteness and Wildness, Space and Freedom

Remoteness and while this is associated with a feeling of trepidation and sometimes even danger. The sublime.

Space and freedom are related to access to the landscape and the uninterrupted and extensive views from the high places within it.

A sense of belonging and attachment to the landscape.

Landscape Quality and Character Policies:

- *PolSQ1: Conserve and enhance the Special Qualities and distinctive character of the AONB's landscape and associated features including the historical built form.*
- *PolSQ2: Safeguard the panoramic views, tranquillity and environmental quality of the AONB for the generations of today and feature" (AONB Management Plan 2016)"*

5.37 Bersham Conservation Area (Policy EC7, **Appendix 5.3**) is located to the south of the southern Parcel of the site. The Conservation Area encompasses an area to the north and south of the River Clywedog and Bersham Road, extending to the east of the A483. The Bersham Conservation Area Assessment and Management Plan (Adopted December 2009) details "*The influences of both the ironworks and the nearby Plas Power Estate are evident in the development of the village the architectural styles and features, which afford Bersham its unique character".*

5.38 There are a number of Listed Buildings within the study area. In close proximity and located within Bersham Conservation Area there are nineteen Buildings Listed (Grade II) that included: St Mary's Plas Power Church, Bersham Lodge, Bersham Mill and Caeau Bridge. Adjacent to the western site boundary (Southern Parcel) there are five Listed Buildings (Grade II) associated with the Plas Power Estate that include: Rhosberse Lodge, Stable Block, Bath House, Ice House and Game Larder. Also located to the west of the site is Plas Power Park Cottage and Rhosberse Lodge (both Grade II Listed), located to the east of Rhos Berse Road at a distance of 0.4km and 0.47km respectively from the site (at its closest point). The northern and eastern boundary of the Plas Power Estate are bound by a stone wall) and railings and gates (Grade II) at the entrances to Plas Park at West drive and West Entrance Drive (for more details regarding the above heritage assets refer to Chapter 7: Cultural Heritage, **Table 7.5**) and See policy EC9 **Appendix 5.3**).

5.39 Erddig Historic Park and Garden is located approximately 2km (at its closest point) to the east of the site. The Country House is a Listed Building (Grade I) dating back to the 17th Century, with its formal garden and landscaped parkland dating back to the 18th Century.

5.40 Offa's Dyke Scheduled Monument runs to the west of the site in a north to south direction and passes within the north-western corner of the Plas Power Estate. It passes circa 125m to the west of the site (at its closest point). Bersham Ironworks Scheduled Monument (Grade II) listed located within Bersham Conservation Area located, 42 meters to the south of the northern portion of the site (Southern Parcel).

5.41 There are also several areas of Ancient Woodland within the study area and adjacent to the site. A large area of Ancient Woodland is located along valley sides and banks of the River Clywedog and the Clywedog Trail runs through this woodland. There are a number of ecological designations including SSSI and SAC as below:

- Gatewen Marsh (SSSI) is located 1.90 km to the north-east of the Proposed Development at the closest point.
- Ruabon/Llantysilio Mountains and Minera (SSSI) and Berwyn a Mynyddoedd De Clwyd / Berwyn and South Clwyd Mountains (SAC) located 2.36 km to the west of the Proposed Development at the closest point.
- Stryt Las a'rHafod (SSSI) and Johnstown Newt Sites (SAC) located 1.94 km to the south of the Proposed Development at the closest point.

5.42 Other designations shown on **Figure 5.1** but outside the 5km radius study area, include Historic Landscapes; RAMSAR site; and Pontcysyllte Aqueduct and Canal World Heritage Site. Given the distance to these designations from the site, they are not anticipated to be affected by the Proposed Development and therefore scoped out of the baseline or the assessment of effects.

Vegetation

5.43 Within the wider study area, the undeveloped farmland largely consists of agricultural fields, divided by hedgerows and a small number of scattered woodlands. The course of the River Clywedog is largely wooded and a narrow belt of woodland runs around the southern periphery of Wrexham. Further areas of woodland are located at Moss Valley Country Park and Erddig Historic Park & Garden.

5.44 The Southern Parcel is partially bound by tree belts (Ancient Woodland) that run adjacent to the A525. A linear tree belt runs to the west of the A483, adjacent to the eastern boundary. Big Wood is located adjacent to the southern boundary and follows the course of River Clywedog, this consists of predominantly Ancient Woodland. The western boundary is more open, consisting of a hedgerow

with individual trees, in the north, with a small area of Ancient Woodland located midway, out with the site boundary. The far southern extents of the western boundary cuts through an open field and does not contain any boundary vegetation.

5.45 Within the Southern Parcel there is an area of plantation, consisting of mixed woodland. This is formed of a linear tree belt running north-south through the middle of this area. This links to a substantial area of woodland in the north, encompassing a large area of standing water/attenuation basin. It is assumed that this plantation and basin have been implemented as mitigation and water management as part of the previous coal mining land-use. The eastern part of this woodland is a plantation located on a previous site of Ancient Woodland. Part of the plantation located to the south and south-east of Home Farm is Ancient Woodland.

5.46 Within the Southern Parcel there are a number of hedgerows that define field boundaries and contain some semi-mature and mature trees. The route of Public Right of Way (BER/1) is bound by a continuous hedgerow to the west of the footpath in the south. The mid-section of the footpath is bound on both sides by gappy hedgerows containing individual trees and in the north by a hedgerow to the west and occasional remnants of hedgerow and individual trees to the west. Some of the vegetation at this part of the site is in poor condition. Please refer to **Figure 2.2a** / **Figure 2.2b** Indicative Site Layout which shows the route of BER/1.

5.47 The fields within the Northern Parcel are divided by mature tree belts. The route of Public Right of Way (BER/8) is bound by vegetation to the east in the south and vegetation to the west in the north. Treed hedgerows run along the northern boundary and an area of woodland and trees hedgerow runs along the eastern boundary. Trees and hedgerow run along the southern boundary and the west is open field. Two linear belts of Ancient Woodland are located to the south of this Parcel, to the south of the A525.

5.48 The fields within the Southern Parcel comprise of improved grassland, rye-grass managed for silage production, and improved grassland fields which are heavily grazed by cattle and sheep. The Northern Parcel comprises of crop including potatoes and wheat, and there are some fringe areas set aside.

Woodland located adjacent to the A525 provides visual separation of the two areas of the site (the Northern and Southern Parcels) and mostly prevents the inter visibility between these areas.

Topography and Drainage

5.49 The topography of the study area is varied consisting of relatively flat ground within the urban area of Wrexham located to the north-east at 80-90m AOD. To the north-west there are a series of mountain ridges, the closest of which is Esclusham Mountain peak located 3.7km from the site at its closest point and standing at 456m AOD. Esclusham Mountain is located within the Bryniau Clwyd a Dyfrdwy/Clwydian Range and Dee Valley AONB. Further south-west is Maesyrychen Mountain and the Llantysilio Mountain ridges.

5.50 The Topography of the site within the Southern Parcel is generally flat with the landform gently sloping from the east to the west. The landform rises up along the southern boundary adjacent to the River Clywedog. The landform is highest in the north-west at 150m AOD and lowest in the south-eastern at 103m AOD and contains localised undulations in the south-west. The landform of the fields along the western boundary, to the west of the A483 are largely flat and consist of made ground that was formerly a site of opencast mining. Fields A, B and C were not part of the coal extraction site and as such have retained a more varied landform and with more steeply sloping topography, mostly falling down to the east but with a high point also in Field C. The topography of the Northern Parcel is more steeply sloping from the west at circa 183m AOD to the north-east at 130m m AOD with a plateaued area in the centre of Field T at 144m AOD.

5.51 A small number of rivers run within the study area. These include the River Alyn and River Dee, located to the north and east of Wrexham respectively. Closest to the site is the River Clywedog, that runs from Esclusham Mountain in the west to the River Dee in the east. This river runs to the south of the site. In this location the river forms a narrow-channelled valley within Big Wood and Plas Power woods.

5.52 Within the north of the site (Northern Parcel) there is a large, manufactured area of standing water/attenuation basin and a small number of field drains.

Transportation

5.53 The A483 forms a major transportation corridor north-south through the middle of the study area and along the western fringe of Wrexham. The Borders Railway Line runs between Bidston and the Wirral Peninsula and runs north-south within the study area, passing within the western extents of Wrexham. A number of A roads service the residential areas of Coedpoeth and Brynteg in the north and Rhostyllen and Rhosllannerchrugog in the south. A series of local lanes run through-out the wider agricultural landscape.

5.54 Public access is provided within the study area via a number of PRoW that include Offa's Dyke National Trail.

5.55 The site lies to the west of the A483, with the Northern and Southern Parcels segregated by the A525 Ruthin Road. Both the Northern and Southern Parcels of the site are accessed via the A525 Ruthin Road. The 33kV cable route from the substations to the south of the site, will connect to the existing Legacy Substation to the south-west of the site, passing to the east of Bersham Ironworks Museum, under the River Clywedog and Clywedog Trail via HDD.

5.56 Two short route options are proposed Options (a) and (b) will both route south of the site before joining the Plas Buckley Road. Option (a) would follow the existing unnamed road west to the north of Cadwgyn Hall, before connecting to Legacy Substation. Option (b) would pass to the south of Cadwgyn Hall through agricultural fields, before connecting to Legacy Substation.

5.57 Public access is available in the Southern Parcel, with Public Right of Way BER/1 running north south within this part of the site and also available within the Northern Parcel, with Public Right of Way BER/8 running north south within the central eastern part of the site. Public access is provided between parcels along the pavement located adjacent to the south of the A525 Ruthin Road.

Landscape Character

5.58 Landscape character can be defined at a variety of scales and a substantial amount of existing published information is available at national, county and district levels (refer to **Figure 5.4**) and Landscape Character with the ZTV (refer to **Figure 5.5**).

National Level

National Landscape Character Areas (NLCA)

5.59 National Landscape Character Areas (NLCAs) are countrywide and form the broad scale landscape character assessment of Wales. The site and majority of the 5km study area falls within NLCA 13: Deeside and Wrexham.

5.60 The key characteristics of this NLCA are as follows:

- *"Historically, much of this area has formed part of the hinterland of Chester… The Wrexham area similarly industrialised early on, taking advantage of its resources of coal, iron-ore, clay and limestone, as well as free-flowing streams to turn industrial water-wheels.*

- *However, it would be wrong to see this area as a purely industrial and commercial landscape. It includes some attractive traditional architecture and countryside too; indeed its early industrial history has bequeathed some important monuments such as the Bersham ironworks near Wrexham.*

- *Narrow, incised, wooded tributary valleys – many running down from the west*

- *Archaeology - variety of historic sites indicate the former strategic importance of the coastal route and the turbulent history of the Marchlands, including Offa's Dyke and Wat's Dyke. Late Medieval parklands and ecclesiastical / funerary sites.*

- *Urban settlements - a strongly settled character is apparent in the central and southern parts of the area, with the relatively large, almost linked settlements of Holywell-Connah's Quay-Mold-Wrexham-Ruabon.*

- *The associated transport links of the A55 Expressway, the A548 coast road and the A483 and A494 trunk roads, present much traffic noise, movement and night lighting.*

- *Mining has long ceased in this area, but around Wrexham trading estates and factories have grown up as staple industries declined.*

- *A border area that has historically been under the influence of both England and Wales; Offa's Dyke is a visible symbol of the struggle for control of this area from the 7th to the 9th centuries…"*

5.61 It is considered that the parts of the study area within this NLCA conform to the key characteristics stated above. To note some examples of this conformity; the valley to the south of the site is a narrow, incised wooded tributary; there is a strong settlement character of Wrexham within the landscape; and the A483 provided near constant traffic movement and noise during the site work completed for this assessment.

5.62 The easternmost parts of the 5km study area falling within NLCA 12: Clwydian Range. The key characteristics of this NLCA are as follows:

- *"...it includes a number of distinct areas of high ground that encompasses the Clwydian Range core*

- *Rounded, heather clad open hills …...*

- *Hedgerows and numerous hedgerow trees - improved hill sheep grazing and lowland pasture.*

- *Quarries and mining heritage.*

- *...undulating ridge lines and skylines, together with rolling profiles, create a distinctive landscape of sinuous, organic form….This creates a simple landscape, very much marked with seasonal colour contrast, with a variety of vegetation types, including heather, gorse, bracken and bilberry".*

- *The Clwydian Range provides the nearest upland countryside recreation haven in Wales, for the populations of the greater Deeside, Wrexham, Chester and Merseyside areas.*

- *The underlying geology gives rise to well-drained loamy and fine loamy or silty soils, supporting a range of land cover elements and land-uses including hill sheep farmland, unenclosed moorland, lowland sheep-grazed pasture and occasional areas of arable* cultivation".

5.63 The section of this NCLA within the west of the study area is considered to conform with the key characteristics here detailed.

LANDMAP

5.64 LANDMAP is a Geographical Information System (GIS) based resource that records and evaluates landscape characteristics, qualities and influences of the Welsh landscape and comprises a nationally consistent dataset administered by NRW. It comprises five spatially related datasets or aspect layers as follows:

- *Geological Landscape: "considers the physical, primarily geological, influences that have shaped the contemporary landscape and identifies those landscape qualities which are linked to the control or influence exerted by bedrock, surface processes, landforms and hydrology";*

- *Landscape Habitats: "Focuses on recording habitat features, characteristics and their spatial relationships within the context of the wider landscape";*

- *Visual and Sensory: "Maps landscape characteristics and qualities as perceived through our senses, primarily visually. The physical attributes of landform and land cover, their visible patterns and their interrelationship";*

- *Historic Landscape: "Landscape characteristics that depend on key historic land uses, patterns and features. Identifies only those classes of historic land uses, patterns and features that are prominent and contribute to the overall historic character of the present landscape."; and*

- *Cultural Landscape: "Describes the links between landscape and people, from the way in which cultural, or human activity shapes the landscape, to the way in which culture shapes the way we respond to landscape. Focus is on mapping the landscape where it has been, or is being, shaped by a particular cultural activity or process, or where it has been directly represented, depicted or described in art, literature or folklore".*

5.65 LANDMAP is used *"to help sustainable decision-making and natural resource planning at a range of levels from local to national whilst ensuring transparency in decision-making".* It is also *"used to inform planning, policy, strategies, evidence and advice"* and Guidance Note GN46 provides advice on how LANDMAP information should be used in LVIAs.

5.66 The LANDMAP dataset for the study area is shown on **Figures 5.6** and **5.7**, and further detailed included within **Appendix 5.4**. For the assessment of likely significant landscape effects, we have primarily utilised the Wrexham LANDMAP Supplementary Planning Guidance (adopted March 2007) described below. We have referred back to the LANDMAP data for the evaluation scores to assist with judgements on sensitivity. For this chapter, we primarily focus on the Visual and Sensory Aspect Areas and their Evaluation.

LANDMAP Visual and Sensory Areas

5.67 The LANDMAP Visual and Sensory Aspect is a process of mapping what is perceived through our senses, primarily visual, however the senses of hearing, smell and touch are also considered as part of a perceived characteristics of the landscape as is aesthetic and perceptual criteria. The Visual and Sensory Aspect utilises consistent definitions, methods of assessment and wording to achieve greater objectivity. The following Visual and Sensory Aspect Areas located within the redline boundary and will be directly affected by the Proposed Development. These Aspect Areas have also been used to inform our judgement of the value and sensitivity of the Landscape Character Areas defined in the Wrexham LCA used for the assessment of effects (see **Tables 5.2-5.8**). The locations of the Visual and Sensory Aspect Areas are illustrated on **Figure 5.6**.

- Plas Power Park: Area unique ID WRXHMVS082
- Clywedog Valley – Bersham: Area unique ID WRXHMVS019
- West Wrexham Lower Slopes: Area unique ID WRXHMVS073
- A483 Mold Road Corridor: Area unique ID WRXHMVS065

5.68 The cable route also pass through the following, which would have the potential for temporary construction effects only;

- A483 and environs - Rhostyllen to Ruabon: Area unique ID WRXHMVS038
- North, West and South of Rhos: Area unique ID WRXHMVS020.

5.69 The following Visual and Sensory areas located outside of the redline boundary, within the wider study area and would be indirectly affected by the Proposed Development and are used to inform the value and sensitivity of the Landscape Character Areas as mentioned above. The locations of the Visual and Sensory Aspect Areas are illustrated on **Figure 5.6**.

- Gwynfryn and Bwlichgwyn area,
- Mining & Quarrying Communities
- Coedpoeth
- Bersham Tip & Former Collery Site,
- North, West and South of Rhos,
- A483 and environs – Rhostyllen to Ruabon
- Rhos Johnstown & Penycae
- Brybo, Tanyfron & Pentre Broughton
- Gwersyllt Bradley, Llay & Sydallt
- Maelor South of Wrexham
- Marchwiel Hall & Bryn y Grog
- Slopes to the East of Ruabon Mountain

- Ruabon and Esclusham Mountain

5.70 The Survey Details Sheets produced for the LANDMAP assessment for the Visual and Sensory Aspect Areas located within the site area, considered as part of this assessment, are shown in **Appendix 5.4**. LANDMAP includes an evaluation for the aspect area that are informed by evaluation criteria specific to each dataset, each evaluation is justified in the survey record called a Survey Details Sheet that are available online. The following sections are of specific relevance / consideration:

- Q3 – Description,
- Q26 - Value (which is a duplicate of Q50 – Overall evaluation),
- Q46 - Scenic quality,
- Q47 - Integrity,
- Q48 - Character,
- Q49 - Rarity and
- Q50 - Overall evaluation

District Level

5.71 WCBC have produced Wrexham LANDMAP Supplementary Planning Guidance (SPG) that was adopted in March 2007, and this will be used to as the baseline landscape resource for this assessment.

Wrexham LANDMAP Supplementary Planning Guidance (SPG) (March 2007)

"Wrexham LANDMAP is part of an all-Wales initiative developed by the Countryside Council for Wales (CCW) and the Welsh Landscape Partnership Group. The study covers aspects of Earth Science, Biodiversity, Visual and Sensory, History & Archaeology and Culture, and evaluates them. This has allowed recognisable landscape character areas to be identified, and recommendations made to manage and enhance the rich the varied landscape heritage in an appropriate way for the future" (SPG 2007).

5.72 Wrexham LANDMAP categorises and groups areas into four common broad Landscape Types, which comprise: Rural/ Urban villages, Uplands, Urban and Rural Lowlands and these are sub-divided into a further 27 detailed Landscape Character Areas (LCAs). The site is located within Rural/Upland Villages broad landscape type and three more detailed LCAs including; the West Wrexham Ridges and Valleys – 7d, Clywedog Valleys, Plas Power and Bersham - 9a and the Rhosllanerchrugog Rhostyllen – Ruabon Penycae 7c.

5.73 This assessment assesses the potential change of the Proposed Development upon the LCAs within the site and those within the ZTV envelope. Information regarding the broader Landscape Types is included for wider reference only and is not assessed, as the more unique CAs have been used as at a smaller scale and are more detailed.

Wrexham LANDMAP broad Landscape Types

5.74 The site is located within the Rural / Urban Villages broad Landscape Type. In addition, areas of the ZTV, in the north and south also fall within the broad Landscape Type. Rural / Urban Villages broad Landscape Type is described as being:

"…associated with past coal mining and located on the edge of the uplands and to the north of Wrexham town. The villages are set among farmland, wooded valleys and regenerating or restored landscapes. This complex character area contains main roads, railways and canal, as well as Offa's Dyke and prehistoric hill forts, reflecting Wrexham's history on the border between Wales and England, upland and lowland".

5.75 Further, the key landscape issues associated with the Landscape Type are as follows (abridged):

- *"The future of 'urban fringe' landscapes;*
- *The potential for urban forestry;*
- *…Maintenance of local distinctiveness;*
- *…The need for footpath and cycle links; and*
- *Preservation of local history and industrial archaeology"*

5.76 To the east of the site, and within the extents of the ZTV, is the Rural Lowlands broad Landscape Type which is described as:

"…largely rural and agricultural…. There are scattered farm steadings, attractive small villages and historic landscape features including medieval ridge and furrow and moated site'.

5.77 Also, in the east of the study area and having a very small area located within the ZTV, is the Urban broad Landscape Type which is described as:

"Wrexham town is the main residential, commercial and social centre, and is of regional importance, performing many of the functions of a city in North Wales…".

5.78 To the west of the site and within the extents of the ZTV is the Uplands broad Landscape Type which is described as:

"…an open moorland plateau with remnants of former quarrying and mining. Much of the area is uninhabited…".

5.79 These broad Landscape Types within the study area are considered to be consistent with the descriptions detailed above, extracted from this Wrexham LANDMAP Supplementary Planning Guidance (SPG) (March 2007) .

Wrexham LANDMAP Detailed Character Areas (LCAs)

5.80 The Wrexham LANDMAP LCAs have been used as the baseline for assessing the potential magnitude of change by the Proposed Development and therefore the likely significance of the effect (see **Figure 5.4**). The three in which the site is located are detailed first, followed by those in which the Proposed Development may be potentially discernible (Landscape Character with ZTV **Figure 5.5**). The tables below provide;

- A description as to where the LCA relates to the site and study area, any policy/designations of relevance and field assessment site notes;
- The key characteristics and descriptions from the Wrexham LANDMAP Supplementary Planning Guidance (SPG) (March 2007)
- A reference to the LCAs Regional LANDMAP Visual and Sensory Evaluation (not included in the Wrexham LCA (2007));

5.81 This information has then been used to inform a judgement on the Landscape Value of the CA and its susceptibility to solar development to enable a judgement to be made on the CAs Sensitivity to be reached, as detailed within the Methodology (**Appendix 5.2** Table 2). Further information regarding value is also provided within **Appendix 5.6**.

5.82 The site is located within the following three LCAs:

- West Wrexham Ridges and Valleys 7d – covers the full extents of the Northern Parcel and the majority of the extents of the Southern Parcel. A summary of this LCA and the sensitivity judgement is given in **Table 5.2**;
- Clywedog Valleys, Plas Power and Bersham 9a - covers a very small area in the far south-eastern extents of the Southern Parcel, a short length of the access route and small area of the cable route. A summary of this LCA and the sensitivity judgement is given in **Table 5.3.**
- Rhosllannerchrugog Rhostyllen – Ruabon Penycae 7c – covers most of the location of the cable route. A summary of this LCA and the sensitivity judgement is given in **Table 5.4**.

5.83 Refer to **Appendix 5.4** for further descriptions of LCA in relation to the character of the study area.

5.84 **Table 5.2** below details the landscape character of the West Wrexham Ridges and Valleys LCA 7d and is abridged from the full descriptions in **Appendix 5.4**.

Table 5.2: Key Landscape Character Area Characteristics & Sensitivity of West Wrexham Ridges and Valleys 7d

West Wrexham Ridges and Valleys 7d	
Source	**LCA Character Description**
Desk based study and field assessment	This LCA covers the whole of the Northern Parcel and majority of the south of the Southern Parcel of the site. It has a mixed land-use comprising of urban areas of Wrexham and include Coedpoeth, Broughton and Gwersyllt, these areas are interspersed by farmland and linear wooded valleys. This area is largely urban fringe and functional in character. Part of this area, including within the site, was formally developed for mining and contains evidence of post mining restoration. Areas of Green Wedge (Adopted LDP) fall within parts of this LCA and the designation relates to the conservation and enhancement / protection of the landscape.

Wrexham LANDMAP Landscape Character Area Guidance (March 2007) Summary and Key Characteristics (abridged)	*'A complex area of former mining villages, industry, farmland and woodland in a landscape of distinct ridges and valleys which are aligned towards Wrexham town.* - *…Mixed rural and urban village character* - *Strong NW-SE orientation, with alternating ridges and valleys* - *Hilltop villages separated by woodland, former industrial land and farmland* - *Widespread use of local Cefn sandstone in … distinctive stone walls* - *Changing landscape as post mining restoration and regeneration continue* - *…Border area - Offa's Dyke and site of prehistoric hillfort* - *Visually varied and complex, including lowland, valleys and hill and scarp areas* - *Characteristic undulating hill slopes with wooded valleys* - *Views towards Wrexham and the lowlands* - *Urban villages and Wrexham linked by roads crossing open lowland farmland area* - *Many artificial landforms…* - *…Countryside has remnants of ridge and furrow, regular and irregular fields, but much land has been disturbed* - *Most settlement is related to 19th and 20th century mining and industry* - *…Plas Power colliery buildings have been preserved* - *…Area is affected by A483 corridor,"*
LANDMAP Visual and Sensory Areas:	There are a number of Visual & Sensory Aspect Areas that fall within this CA that include*:* - **Plas Power Park** and **A483 Mold Road Corridor, Wrexham, West Wrexham Hill Slopes, Gwynfryn and Bwlichgwyn area, Mining & Quarrying Communities, and Coedpoeth** that have an overall evaluation of Moderate. - The **West Wrexham Lower Slopes, Brybo, Tanyfron & Pentre Broughton, West Wrexham Lower Slopes and Gwersyllt Bradley, Llay & Sydallt** that have an overall evaluation of Low Reference has been made to the descriptions of the Aspect areas (**Appendix 5.4**) and the overall evaluation for the Visual & Sensory Aspect Areas located within the site area is **Moderate to Low**

Criteria	Description	Judgement
Landscape Value	This LCA is largely functional in character and is not considered to have any distinctiveness. Designations largely relate to the area's heritage and include Offa's Dyke prehistoric hill fort, which runs north south in the west of this LCA. There are several Public Rights of Way and Offa's Dyke Trail that run through urban and farmland areas providing opportunities for recreation. The presence of urban areas has resulted in this area containing limited scenic and perceptual qualities. This LCA is considered to be of a **Local** landscape value.	**Local**
Susceptibility *(to Solar Development)*	No capacity studies have been published that encompass the site or study area to make reference to. This mixed-use LCA, area located on the fringes of Wrexham has a character that is largely derived from its function. It has a **Low** susceptibility to this type of temporary (40 years) development.	**Low**
Sensitivity	This LCA has been identified within the Wrexham LANDMAP as having the following Landscape Sensitivity: *'This area continues to accommodate profound changes, but is vulnerable to further loss of local distinctiveness, and coalescence of villages because of continuing development pressure. The small scale of the ridges and valleys means they are sensitive to large scale development, masts and power lines, and inappropriate engineered landforms.* The site would occupy an area within this CA on the fringes of Wrexham. Taking into consideration the changes that have occurred within this **Local** value LCA and its **Low** susceptibility to the type of development proposed it is concluded this LCA would have a **Low** sensitivity.	**Low**

5.85 **Table 5.3** below details the landscape character of the Clywedog Valleys, Plas Power and Bersham Landscape Character Area 9a and is abridged from the full descriptions in **Appendix 5.4**.

Table 5.3: Key Landscape Character Area Characteristics & Sensitivity of Clywedog Valleys, Plas Power and Bersham 9a

Clywedog Valleys, Plas Power and Bersham 9a	
Source	**LCA Description**

Desk based study and field assessment	This is a narrow LCA that follows the course of the River Clywedog and covers a small area of the Plas Estate. This LCA largely sits to the south of the Northern Parcel of the site, incorporating an area within the south-west of the Southern Parcel. This LCA comprises of woodland located predominantly to the north of the River Clywedog with Plas Buckley Road running adjacent to the south and the small village of Bersham located to the west of the A483 that passes through this LCA in the east. This LCA has strong associations with the Plas Estate and includes a number of locally designated sites relating to the area's Iron working heritage, and the village of Bersham is a Conservation Area. Areas of Green Wedge (Adopted LDP) fall within parts of this CA and the designation relates to the conservation and enhancement / protection of the landscape.
Wrexham LANDMAP Landscape Character Area Guidance (March 2007) Summary and Key Characteristics (abridged)	*Small, wooded valley from Wrexham to Minera, providing woodland walks with industrial archaeology and nature conservation interest, historically linked to Plas Power estate and Bersham iron works'* - *'Cut-off areas of countryside, and wooded valley to the east of Wrexham town* - *High potential for recreation, linking town and country* - *…Plas Power estate adjoining Clywedog Valley, surrounded by a magnificent stone wall* - *Varied visual character but area, though close to settlements, is separated from them by walls, roads or topography and has a more tranquil character* - *Substantial Cefn sandstone stone walls of the Plas Power estate surround approximately a square mile of parkland* - *…The area is crossed by Offa's Dyke, a prehistoric military feature of outstanding archaeological value* - *The eastern half of the Plas Power estate is restored land, following post war opencast coal mining, and the remaining designed landscape is in poor condition* - *North of Bersham, the farmland retains a pattern of small fields* - *Recreational and educational area with Clywedog Trail from Wrexham to Minera…* - *Bersham, now a Conservation Area, was a centre for iron working* *The valley is linked to the Plas Power estate, of which the central core (the Hall has been lost) and the higher parts survive'*
LANDMAP Visual and Sensory Areas:	Visual & Sensory Aspect Areas that fall within this CA that include*:* - **Cylwedog Valley Bersham** and Mining & Quarrying Communities have an overall evaluation of Moderate.

	Reference has been made to the descriptions of the Aspect areas (**Appendix 5.4**) and an overall rating of **Moderate** is concluded.	
Criteria	**Description**	**Judgement**
Landscape Value	The Clywedog Valleys, Plas Power and Bersham 9a contains a large number of cultural heritage assets and associations relating to former Iron works. Offer's Dyke (Scheduled Monument) is a prehistoric hill fort. The River Clywedog contains habits of ecological importance with the associated Clywedog Trail and Bersham Ironworks Museum providing recreational opportunities. Big Wood consists of predominantly Ancient Woodland. The landscape is in mostly a good condition and well contained with the wooded valley side, which contains areas of tranquillity and visual/scenic interest. Some of the Plas Estate landscape is in a poor condition and in need of repair and management. This LCA is considered to be of a **Local to Regional** landscape value.	**Local to Regional**
Susceptibility *(to solar Development)*	No capacity studies have been published that encompass the site or study area to make reference to. Whilst this LCA has a distinctive historical character, the majority of the development would be located on the fringes of this LCA with only a small area falling within the LCA itself, in addition existing woodland within this LCA provides an effective buffer to much of the site and the development would be temporary (40 years only). This LCA is considered to have a **Medium** susceptibility to the Proposed Development.	**Medium**
Sensitivity	This LCA has been identified within the Wrexham LANDMAP as having the following Landscape Sensitivity: *'The scale of the valley is very small, and any incongruous development within it or nearby, or loss of tree cover could affect its character. The Plas Power estate and Bersham areas are vulnerable to recreational and residential development because of their proximity to Wrexham town'.* The site would occupy a small area within this LCA, with the majority of the site located to the north of this LCA. This LCA has **Local to Regional** value and its **Medium** susceptibility to the type of development proposed it is concluded this LCA would have a **Medium** sensitivity to a development of the type proposed.	**Medium**

5.86 **Table 5.4** below details the landscape character of the Rhosllanerchrugog Rhostyllen – Ruabon Penycae 7c and is abridged from the full descriptions in **Appendix 5.4.**

Table 5.4: Key Landscape Character Area Characteristics & Sensitivity of Rhosllanerchrugog, Rhostyllen, Ruabon, Pen y Cae 7c

Rhossllanerchrugog, Rhostyllen, Ruabon, Pen y Cae 7c	
Source	**Character Description**
Desk based study and field assessment	This LCA is located in the south of the study area and the majority of the cable route. The Northern and Southern Parcels of the site would be located to the north of this LCA. This LCA has a mixed character consisting of open farmland and residential settlements that are mainly of 19th-20th century origin and located in the north-east at Rhostyllen and the south at Rhosllanerchrugog. The open farmland is dissected by hedgerows and local roads with the A483 running adjacent to the LCAs eastern boundary. Evidence of the area's former coal mining land use is evident at Bersham and Haford Collieries and the network of disused industrial railways. Modern industrial and commercial areas are now linked to Wrexham town and individual development sites are found within the farmland and include an electricity sub-station / Education Centre and Solar development located near Esclusham. Areas of Green Wedge (Adopted LDP) fall within parts of this LCA and the designation relates to the conservation and enhancement / protection of the landscape.
Wrexham LANDMAP Landscape Character Area Guidance (March 2007) Summary and Key Characteristics (abridged)	*'Closely built former mining communities with a rich cultural heritage, located on the lower slopes of Ruabon Mountain, and distinguished by the widespread use of local Ruabon red brick'* - *'Rural and urban areas affected by history of mining and quarrying.* - *Lower slopes of Ruabon Mountain consisting of undulating farmland, with residential and industrial development.* - *Bersham colliery and tip, and the former Hafod tip, now restored, are landmarks* - *Coal mining remains are frequent but Bersham Colliery …….is of particularly high value. Industrial sites are linked by a network of disused industrial railways* - *Border area - prehistoric military hillfort at Garden and Offa's Dyke, marking a former political and military boundary.'*
LANDMAP Visual and Sensory Areas:	Visual & Sensory Aspect Areas that fall within this CA that include: - **Bersham Tip & Former Collery Site, North, West and South of Rhos, A483 and environs – Rhostyllen to Ruabon and Rhos Johnstown & Penycae** have an overall evaluation of Moderate. Reference has been made to the descriptions of the Aspect areas (**Appendix 5.4**) and the overall evaluation for the Visual & Sensory Aspect Areas located within the site area is **Moderate**.

Criteria	Description	Judgement
Landscape Value	Rhosllanerchrugog, Rhostyllen, Ruabon, Pen y Cae 7c has a mixed character. The area includes several listed buildings associated with the areas former coal mining heritage. Offa's Dyke - prehistoric hill fort follows the border between England and Wales. The Offa's Dyke Path/ National Trail provides recreational opportunities along with a number of Public Rights of Way that run within areas of farmland. Small areas of ancient woodland are located within this LCA. The landscape is locally distinctive and includes scenic and perceptual associations that are largely gained from the adjacent Clwydian Range and Dee Valley AONB that houses the Ruabon and Exclusham Mountains. This LCA is considered to be of a **Local** landscape value.	**Local**
Susceptibility *(to solar Development)*	No capacity studies have been published that encompass the site or study area to make reference to. Whilst this LCA has a distinctive historical character, it also has existing areas of development that include a sub-station / Education Centre and solar development located near Esclusham. The Proposed Development (cable route) would be temporary (during the construction period for the cable route only). In summary this LCA is considered to have a **Low** susceptibility to this type of development.	**Low**
Sensitivity	This LCA has been identified within the Wrexham LANDMAP as having the following Landscape Sensitivity: '*The distinctive Welsh identity of the area is vulnerable to development pressure, particularly infill housing of standardised design and materials. The A483 corridor is visually threatened by nearby landfill, masts, building development and power lines. Surrounding farmland is also very vulnerable to urban pressures'.* The site (comprising of cable route only) would occupy a small area within this LCA on the fringes of Wrexham. Taking into consideration the temporary changes that have occurred within this **Local** value CA and its **Low** susceptibility to the type of development proposed it is concluded this CA would have a **Low** sensitivity.	**Low**

5.87 The site boundary does not fall within the LCAs listed below. See Landscape Character with ZTV **Figure 5.5** for all of the LCAs within the study area and their locations in relation to the site. However, they are included within the ZTV envelope and thus have the potential to be indirectly affected or perceptually affected by the Proposed Development and are considered to be of relevance to the assessment. The details of the following LCA's have therefore been included;

- Wrexham Town 10 (**Table 5.5**) – small area on the western fringe only
- Welsh Maelor 13a (**Table 5.6**) isolated areas
- Eastern Slopes of Ruabon Mountain 5b (**Table 5.7**) – various areas
- Ruabon and Esclusham Mountain 1b (**Table 5.8**) – isolated areas

5.88 Refer to **Appendix 5.5** for full descriptions of LCA in relation to the character of the study area.

5.89 **Table 5.5** below details the landscape character of the Wrexham Town LCA 10

Table 5.5: Key Landscape Character Area Characteristics & Sensitivity of Wrexham Town 10

Wrexham Town 10	
Source	**Character Description**
Desk based study and field assessment	This LCA is located to the north-east of the study area and site. The A483 runs adjacent to the west of this LCA forming a barrier to the adjacent LCA and the site. This LCA comprises mixed- use, built development and has a historic retail core. A mixture of residential areas, which includes extensive post war properties and non-residential uses are located within the town and its fringes. Wrexham is a historical market town that has both English and Welsh influences and is linked to ex-mining communities and contains.
Wrexham LANDMAP	The following has been taken from Wrexham LANDMAP descriptions and reflects the character of the LCA: - Extensive outer areas of post-war and recent housing, including planned garden village estates, public housing and cul-de-sac modern estates - *'Gently undulating terrain'* - *'Views to Ruabon and Esclusham Mountain, purple, green or brown according to season'* - *'Central historic and retail core, surrounded by areas of non-residential uses and remaining areas of older housing'* - *'Extensive outer areas of post-war and recent housing, including planned garden village estates, public housing and cul-de-sac modern estates'* *"Wrexham is a large thriving historic market town set on a lowland plateau, forming a regional and local centre with strong cultural traditions"*
LANDMAP Visual and Sensory Areas:	Visual & Sensory Aspect Areas that fall within this LCA that include*:* - **Wrexham** has an overall evaluation of Moderate. Reference has been made to the descriptions of the Aspect areas (**Appendix 5.4**) and the overall evaluation for the Visual & Sensory Aspect Areas located within the site area is **Moderate**.

Criteria	Description	Judgement
Landscape Value	The Wrexham Town LCA 10 is an urban area that has historical ex-coal mining influences and contains a number of listed buildings and three conservation areas that are of historical interest. This LCA is considered to be of a **Local** landscape value.	**Local**
Susceptibility *(to Solar Development)*	The site would not be located within this LCA. Built development has restricted the extents of the ZTV within this LCA and only two small areas of the ZTV fall within the LCA. This LCAs comprises of mixed residential and industrial development and has a low sensitivity to the Proposed Development.	**Low**
Sensitivity	This LCA has been identified within the Wrexham LANDMAP as having the following Landscape Sensitivity: *'Wrexham town is vulnerable to new development which takes insufficient account of existing character, scale, physical characteristics, open space network, archaeology or other factors. It is very sensitive to the cumulative impact of small changes which can erode local distinctiveness'.* The site would not be located within this LCA that is located on the fringes of Wrexham. Taking into consideration the changes that have occurred within this **Local** value LCA and its **Low** susceptibility to the type of development proposed it is concluded this LCA would have a **Low** sensitivity.	Low

5.90 **Table 5.6** below details the landscape character of the Welsh Maelor LCA 13a

Table 5.6: Key Landscape Character Area Characteristics & Sensitivity of Welsh Maelor 13a

Welsh Maelor 13a	
Source	**Character Description**
Desk based study and field assessment	This LCA is located to the east of the study area and to the east of the site. The A483 runs adjacent to the west of this LCA forming a barrier to the adjacent LCA and the site. This LCA consists of predominately open farmland interspersed by local roads, residential properties and extensive area of Parkland associated with Erddig Historic Park & Garden, National Trust property. Areas of woodland, including Ancient Woodland are located through-out this LCA, along the southern fringes of Wrexham, to the north of Erddig and adjacent to the River Clywedog. There is little evidence of development within this LCA which has a rural/estate character, however it has been influenced by its proximity to Wrexham urban fringe.

Wrexham LANDMAP	The following has been taken from Wrexham LANDMAP descriptions and reflects the character of the LCA: - *'Historic designed estates influence a large proportion of this area* - *Tranquillity and landscape quality affected by A483 and pylons to west* - *Important designed parklands on Cadw Register at Erddig* - *High level of recreational use in Erddig and Clywedog'* - Generally, an abundance of well managed hedgerows and hedgerow trees Wrexham LANDMAP LCA summary: *'Attractive undulating lowland farmland to the south of Wrexham town and west of the River Dee, containing a number of large estates'.*
LANDMAP Visual and Sensory Areas:	Visual & Sensory Aspect Areas that fall within this CA that include*:* - **Bersham, Tip & Former Colliery site, Maelor South of Wrexham** and **Marchwiel Hall & Bryn y Grog** have an overall evaluation of Moderate - **Erddig Estate** has an overall evaluation of Outstanding. Reference has been made to the descriptions of the Aspect areas (**Appendix 5.4**) and the overall evaluation for the Visual & Sensory Aspect Areas located within the study area is **High**.

Criteria	Description	Judgement
Landscape Value	The Welsh Maelor LCA 13a has a rural/estate character that is associated with Erddig - Historic Park and Garden that has a local distinctiveness within the area. Erddig has cultural heritage associations and provides opportunities for recreation along with a number of Public Rights of Way. This LCA contains well managed hedgerows and hedgerow trees and has an overall good condition. This area contains a number of listed buildings. Ancient Woodland and Erddig contains elements of tranquillity, however external elements such as the A483 and pylons have affected this LCA along with its proximity to Wrexham urban fringe.	**National**
Susceptibility *(to solar Development)*	No capacity studies have been published that encompass the site or study area to make reference to. The site is not located within this LCA which is located to the west of the A483 and the urban area of Rhostyllen. Fragmented areas of the ZTV fall within this LCA. This LCA has already been affected by urban development within Wrexham. The Proposed Development would be of a low height and temporary (40 years)	**Low**

	and it is therefore considered this LCA would have a **Low** susceptibility to this type of development.	
Sensitivity	This LCA has been identified within the Wrexham LANDMAP as having the following Landscape Sensitivity: *'The traditional Welsh Maelor landscape is very vulnerable to continuing development and recreational pressures, to economic changes which threaten traditional farming, and from land use practices and development which do not take historical landscape features into account'.* The sensitivity of this LCA has already been affected by its proximity to Wrexham and the site would be located some distance from this CA. Taking into consideration this CAs **National** value and **Low** susceptibility to the type of development proposed, it is concluded this CA would have a **Medium** sensitivity.	**Medium**

5.91 **Table 5.7** below details the landscape character of the Eastern Slopes of Ruabon Mountain LCA 5b.

Table 5.7: Key Landscape Character Area Characteristics & Sensitivity of Slopes to the Eastern Slopes of Ruabon Mountain 5b

Slopes to the Eastern Slopes of Ruabon Mountain 5b	
Source	**Character Description**
Desk based study and field assessment	This LCA is located in the west of the study area and to the west of the site. This LCA forms an area of sloping east facing land encompassing the eastern extents of the Bryniau Clwyd a Dyfrdwy/Clwydian Range and low land areas to the east. The Clwydian Range and Dee Valley AONB is located in the west with the uplands consists of moorland. The lower slopes and lowland consist of pastoral farmland, a network of narrow winding lanes bound by mixed hedges and isolated properties.
Wrexham LANDMAP	The following has been taken from Wrexham LANDMAP descriptions and reflects the character of the LCA: - *'Scenic area between moorland and developed lowlands* - *East-facing slopes from between 180 m to 350 m above sea level form the flanks of the Ruabon Mountain plateau*

	- *The small irregular fields characteristic of the area evolved from progressive enclosure of the commons* - *Rich cultural heritage'* Wrexham LANDMAP LCA summary: *'East-facing slopes of Ruabon/Esclusham Mountain below the moorland edge, with a landscape of relatively unspoilt pastoral farmland, small farms, woodlands and reservoirs'.*	
LANDMAP Visual and Sensory Areas:	Visual & Sensory Aspect Areas that fall within this CA that include*:* - **Slopes to the East of Ruabon Mountain** has an overall evaluation of High. Reference has been made to the descriptions of the Aspect areas (**Appendix 5.4**) and the overall evaluation for the Visual & Sensory Aspect Areas located within the study area is **High**.	**High**

Criteria	Description	Judgement
Landscape Value	The upper slopes of the Bryniau Clwyd a Dyfrdwy/Clwydian Range provide extensive views of the pastoral farmland, River Cylwedog valley, Wrexham and its urban fringe that include an extensive network of powerlines. In contrast the upper slopes to west and adjacent Ruabon and Esclusham Mountain LCA are visually distinctive and contain areas of wilderness and tranquillity. A number of Public Rights of Way are located within this area providing recreational access to the AONB which is recognised as of national importance. Areas of Ancient woodland are located within this LCA along with a small number of Listed buildings.	**National**
Susceptibility *(to solar Development)*	No capacity studies have been published that encompass the site or study area to make reference to. The site is not located within this LCA and fragmented areas of the ZTV fall within this LCA which has been affected by urban development associated with Wrexham located to the north-east and around Esclusham. The Proposed Development would be temporary (40 years). In summary this LCA is considered to have a medium susceptibility to this type of development.	**Medium**

Sensitivity	This LCA has been identified within the Wrexham LANDMAP as having the following Landscape Sensitivity: *'Very sensitive - the area is high and open but close to settlements and is very vulnerable to loss of vernacular building character and development of masts and power lines, as well as changes in agricultural practices due to economic and climatic factors'.* The sensitivity of this LCA has already been affected by its proximity to Wrexham and the Proposed Development would form an extension to the urban area of Wrexham located some distance to the north-east of this LCA. Taking into consideration this LCA's **National** value and **Medium** susceptibility to the type of development proposed, it is concluded this LCA would have a **Medium to High** sensitivity.	**Medium to High**

5.92 **Table 5.8** below details the landscape character of the Ruabon and Esclusham Mountain LCA 1b.

Table 5.8: Key Landscape Character Area Characteristics & Sensitivity of Ruabon and Esclusham Mountain 1b

Ruabon and Esclusham Mountain 1b	
Source	**Character Description**
Desk based study and field assessment	This LCA is located in the west of the study area and to the west of the site. This LCA encompasses the Clwydian Range and Dee Valley AONB and consists of mountainous open moorland located within the Bryniau Clwyd a Dyfrdwy/Clwydian Range. This expansive open landscape is largely undeveloped. A local lane (unnamed) provides vehicular access through the area and services small informal parking areas, isolated properties and footpaths. Tree cover is limited, and extensive views are obtained with the Esclusham Mountain Viewpoint located in the north. This is a largely untouched area of scenic and recreational character that has a wide-ranging prescience in the landscape.
Wrexham LANDMAP	The following has been taken from Wrexham LANDMAP descriptions and reflects the character of the LCA: - *'Upland moorland plateau* - *Seen as relatively wild and natural* - *Of high value for wildlife*

	- *Important archaeological remains* - *Of value for informal recreation* - *Large scale landscape, high and open with good long-distance views* - *Few footpaths, but most is open access land under the Countryside and Rights Of Way Act 2000'* *'Unenclosed and uninhabited upland moorland plateau seen from the Wrexham lowlands, valued for its scenery, dry heath vegetation, wildlife and archaeological remains'.*	
LANDMAP Visual and Sensory Areas:	Visual & Sensory Aspect Areas that fall within this LCA that include*:* **Ruabon and Esclusham Mountain** has an overall evaluation of High. Reference has been made to the descriptions of the Aspect areas (**Appendix 5.4**) and the overall evaluation for the Visual & Sensory Aspect Areas located within the study area is **High.**	**High**

Criteria	**Description**	**Judgement**
Landscape Value	This LCA is located within the Clwydian Range & Dee Valley AONB recognised as being of national importance for its scenic qualities. Due to the area's remoteness and lack of development it has a perception of wilderness and tranquillity. However, the prescience of Wrexham and urban fringe development to the east has had some bearing on this perception. The area is open access land and has a high recreational value. It is also of archaeological importance and wildlife value.	**National**
Susceptibility *(to solar Development)*	No capacity studies have been published that encompass the site or study area to make reference to. The site is not located within this LCA, however due to its elevated topography the ZTV encompasses a significant area on the eastern mountain side. Elevated location therefore adjacent areas have perceptual and visual influence on this area, it is an open landscape with less visual barriers.	**Medium**

Sensitivity	This LCA has been identified within the Wrexham LANDMAP as having the following Landscape Sensitivity: *'Smooth profile seen from the eastern lowlands is vulnerable to development which might break the skyline, such as masts. The heather moorland vegetation is sensitive to changes in climate, changes in management and increased recreational pressure'.* The sensitivity of this LCA has already been affected by its proximity to Wrexham and the Proposed Development would form an extension to the urban area of Wrexham located some distance to the north-east of this LCA. Taking into consideration this LCAs **National** value and **Medium** susceptibility to the type of development proposed, it is concluded this LCA would have a **Medium to High** sensitivity.	**Medium to High**

5.93 There are a number of LCA's located outwith of the ZTV visual envelope, which are located on the periphery of the study area, and so are not considered to be of relevance to this assessment as no likely significant effects are anticipated from the Proposed Development. These include the following LCAs that have been scoped out of the assessment:

- Minera Gwynfyn Bwlchgwyn; and
- Gwersyllt, Liay, Gresford, Borras.

Site Level Landscape Character, Value and Sensitivity

5.94 The character of the site is described in the text below along with an evaluation of the range of factors taken into consideration when evaluating the overall value of the local landscape.

5.95 GLVIA3 defines value as;

"…*the relative value that is attached to different landscapes by society, bearing in mind that a landscape may be valued by different stakeholders for a whole variety of reasons… A review of existing landscape designations is usually the starting point to understanding landscape value, but the value attached to undesignated landscapes also needs to be carefully considered and individual elements of the landscape – such as trees, buildings or hedgerows may also have value*."

5.96 GLVIA3 Box 5.1, identifies a range of factors to consider when establishing value. These are also useful in identifying the particular qualities present within the site.

5.97 An evaluation of the value attached to undesignated landscapes has been considered with reference made to GLVIA the and the Landscape Institutes Technical Guidance note 02/21 - Assessing landscape value outside of national designations. A value table has been produced detailing the range of factors that can be considered when identifying landscape value of non-designated landscapes within the site and this can be found in **Appendix 5.6**. Information contained within the value table has informed the evaluation of landscape value as detailed below. In the determination of value reference has been made to published studies that includes Wrexham LANDMAP LCA's and LANDMAP Visual and Sensory Aspect Areas: Plas Power Park, Clywedog Valley – Bersham and West Wrexham Lower Slopes that fall within the site. These can be found in **Appendix 5.4**.

5.98 The overall land use of the site is agricultural with its landscape character having been influenced by a combination of its current agricultural land use and historical associations derived from its former uses that include coal extraction, the Plas Power Estate and the former iron works at Bersham that are still evident within the landscape today.

5.99 Modern day development has also affected the character of the site with urban development on the periphery of Wrexham having expanded towards the east of the site and includes the A525 and A483 running to the north and east respectively. Plas Buckley Road runs to the south of the site and has influenced the sites character to a lesser extent due to the woodland that contains the road and the river corridor.

5.100 The site itself adjoins areas of Ancient Woodland that are of natural heritage value. The River Clywedog located to the south of the site is of local ecological value and contains areas of tranquillity and provides recreational opportunities along the Clywedog Trail and Bersham Paper mill (Grade II). Public Right of Way BER/1 runs through the south of the site and BER/8 runs through the north and both provide access and recreational opportunities with the Site.

5.101 The proximity of Wrexham and the A525 and A483 that run in close proximity to the site have influenced the area's character and resulted in nearby areas within the site possessing limited scenic opportunities or areas of tranquillity. However, there is intervisibility with the AONB located within the wider study area to the west. In addition, the River Clywedog is contained by woodland and has been influenced to a lesser extent by urban development associated with Wrexham.

5.102 The two land parcels that form the site are segregated by the A525 and although they both comprise of open agricultural land, the Southern Parcel being under mostly pastural use and the Northern Parcel being in grassland / crop production use they both possess slightly different intrinsic characters. The Southern Parcel is more extensive, adjoins areas of woodland and has greater associations with the Plas Estate, Bersham and its historical iron works. However, evidence of former coal extraction is evident in the straight field patterns. The Northern Parcel has more organic field patterns, areas of treed vegetation, and was not used for coal extraction, however it does have more associations with surrounding urban areas and detracting elements include two adjacent pylons located near the western boundary. Further information regarding the Proposed Development site level Landscape Value is included within **Appendix 5.6**. On balance it is considered both land Parcels that form the site have a **Medium** landscape value.

5.103 The site has been influenced by its proximity to Wrexham and is considered to have a **Low to Medium** susceptibility to the Proposed Development. In summary taking into account the evaluation above that has been informed by the landscape value tables, **Appendix 5.6** the Wrexham LANDMAP LCA summaries, **Appendix 5.5** and the LANDMAP Visual and Sensory Aspect Areas **Appendix 5.4,** the site is considered to have a **Medium** sensitivity to the type of development proposed.

Visual Resource

Zone of Theoretical Visibility (ZTV)

5.104 To assist in understanding the baseline visual resources of the site and the areas surrounding the site, a ZTV was generated using markers along the boundaries of the built areas within the Proposed Development. The current study area chosen for the ZTV is a 5km radius and is included at **Figure 5.2.**

5.105 To determine the extent of the study area for a landscape and visual assessment, a computer generated ZTV is frequently used. Preparation of a ZTV is recommended in GLVIA3 (para. 6.8, p.103) as, "*it makes clear that the area so defined only shows land from which the proposal may*

theoretically be visible." A ZTV can be completed using a '*bare earth'* scenario, i.e. no intervening structures or significant vegetation, and a '*with barriers'* scenario using existing screening features, i.e. urban areas and existing vegetation. **Figure 5.2** is a 'with barriers' ZTV.

5.106 The preliminary ZTV was prepared based on an assumed maximum solar panel height of 3m above existing ground levels (AGL) and 3.9m (AGL) for the BESS and substations. The ZTV was compiled assuming observer height as 1.5m at eye level and takes into account screening effects of local settlements at 9m and existing vegetation / woodland at a height of 10m. 24 origin points, from within the site, have been used to illustrate the full parameters of the Proposed Development. Including:

- 23 origin points (in total), set at 3m (AGL), within the centre of each of the fields of the site which would contain solar panels; and,
- 1 origin at the approximate highest point within the site.

5.107 OS Terrain 5 data has been used for generating the ground model for the ZTV.

View Ranges

5.108 For the purposes of this assessment, views have been classified according to three distances 'ranges' as set out in **Table 5.9**.

Table 5.9: View Ranges

Range	Distance Threshold	Reasoning Description
Close	Less than 1 km	At close range the Proposed Development could appear as a 'prominent' feature and visual receptors could experience high to medium/low magnitude of change when compared to existing views.
Medium	Between 1 km and 5 km	In medium range views the Proposed Development could appear as 'present' features and visual receptors could experience medium/low to negligible magnitude of change compared to the existing situation.
Long	More than 5 km	In long range views the Proposed Development would read as part of the landscape and visual resources would tend to experience a low to negligible or lower magnitude of change compared to the existing situation. Given the 3m height of the Proposed Development no long-distance views have been included for the purpose of this assessment.

Representative Viewpoints

5.109 A number of viewpoints were selected to represent the receptors within the study area, from which to assess the change in views that would result from the Proposed Development. All viewpoints are situated in publicly accessible locations within the extent of the ZTV, with a range of distances and orientation to the Proposed Development. Locations of the Representative viewpoints is shown at **Figure 5.2** and photographs within **Figure 5.8**. Photomontages are illustrated at **Figure 5.9.**

5.110 Winter photographs were taken in February 2021. Overall visibility was good, and no summer photographs have been taken as winter photography represents the worst case scenario due to the absence of screening foliage. As such when considering effects at year 15 summer any judgements

have been made using professional judgement. However, the site was visited during winter 2022 and summer 2023. **Table 5.10** below describes the location of the Representative viewpoints for this assessment.

Table 5.10: Representative Viewpoints No. / Name / Sensitivity

Viewpoint & Sensitivity	OS Grid Ref	Distance	View Location Description
VP1: Public Right of Way (BER/1) north, looking west **High**	330486.5 350395.3	Close Within northern site boundary	View from footpath running north to south within the site (Southern Parcel) of pastural/agricultural fields that form part of the Plas Power Estate. Close view from within the north of the site looking west to land located to the east of Field C and the north of Field I, that is separated from the footpath by a post and wire fence. Vegetation is sparse along the west of the footpath in the north, and this viewpoint is representative of the open views from the stretch of footpath within the northern part of the PRoW within the Southern Parcel. A mix of deciduous and coniferous woodland located to the south and west. The woodland located to the south restricts views of Field I. Longer distance views are obtained where the woodland does not fully bound the extents of the adjacent field. Views of parts of Fields C and G are obtained beyond. Views of the Bryniau Clwyd a Dyffryn Dyfrdwy/Clwydian Range and Dee Valley AONB are obtained in the distance.
VP2: Public Right of Way (BER/1) near Bersham Conservation Area **High**	330768.4 349269.0	Close Within southern site boundary	View from the south of the footpath running north to south within the site (Southern Parcel) of pastural fields Close view from within the south of the site, and of the southern extents of Field Q. Open grassland of Field Q of the site is viewed in the foreground with Fields P, N and I located beyond. The hedgerow located along the western boundary of Field Q screens views of the site to the west. Filtered views of vehicles traveling on the A483, adjacent to the east of the site are obtained at gaps within the roadside vegetation. Views of Wrexham Ross Transmitter and housing on rising land at New Broughton are obtained to the north of the site.
VP3: Public Right of Way (BER/10) near scheduled monument **High**	329392.5 350491.7	Close 280 m	Elevated, close view from footpath located to the west of the site. Extensive views of agricultural grassland are obtained to the east, with the urban area of Wrexham viewed in the distance beyond the site. Views of Fields A, B and C within the site (Southern Parcel) are obtained in the foreground with offsite woodland located to the east of these fields viewed beyond. This woodland screens views of Fields E and F located beyond. The hedgerow along the south of the A525 is visible to the north-east and long distant views of tall buildings associated with Wrexham University (Village accommodation) are obtained and partially screened by intervening vegetation.

Viewpoint & Sensitivity	OS Grid Ref	Distance	View Location Description
VP4: Plas Buckley Road looking east from local road. **Low**	329490.5 349484.1	Close 585 m	Elevated close view from a road to the west of the site (Southern Parcel) looking north-east. Pastural grassland views from the road are obtained at isolated locations only where gaps in the roadside hedgerow occur. Views to the south-east are restricted by roadside hedgerows and landform, with no views of the northern extents of the site (Northern Parcel) obtained. The view is of pastural fields and woodland associated with the River Clywedog valley located to the south of the site (Southern Parcel). The grassland in the foreground is divided by post and wire fencing with a single communications pole forming the only detracting feature within the view. More extensive views to the north-east and of the west of site (Southern Parcel), Fields A, B, C, L and M are mostly screened by woodland associated with the River Clywedog.
VP5: Tan Llan, local road to the north-west **Low**	329307.8 351079.4	Close 240 m	View south-east from a field gate on Tan Llan towards the north of the site (Northern Parcel). This viewpoint is located at a break in the vegetation that separates the adjacent agricultural fields from Tan Llan and is not widely available from the remaining road or properties along it. This elevated view looks across open fields in the foreground towards the urban fringes of Wrexham to the east. Views of electricity pylons located in the west of the site (Northern Parcel) are obtained along with views of Field T, field boundary hedgerows, trees and the barn at Barn Hill, located adjacent to the south of the Northern Parcel. To the south roadside vegetation located along the A525 restricts / filters more extensive views south and no views of the Southern Parcel of the site are obtained. Views are more open and extensive to the east, with filtered glimpses of built development within Wrexham obtained in the far distance.
VP6: Public Right of Way (BER/11) off Penygelli Road, on residential edge of Coedpoeth **High**	328521.5 350673.7	Medium 1.05 km	Elevated view from footpath to the east of the residential area of Coedpoeth, looking across sloping grassland and agricultural fields located to the east of the site. This view is also available to a number of residential properties located on Penygelli Road. Extensive views from this elevated location are obtained across fields in the foreground that are divided by boundary hedgerows with individual mature trees. These trees restrict and filter views of the site (the closest being Field A and B), located to the south of the A525, and east of Rhos-Berse Road, and Field S, Y and U located to the north of the A525. This extensive view comprises both rural and urban elements, with urban development within Wrexham scene in the middle ground and the rural foreground comprising properties located along Penygelli Road and pylons located to the west of the site. Long distance views are of areas of higher ground to the east Wrexham.

Viewpoint & Sensitivity	OS Grid Ref	Distance	View Location Description
VP7: Public Right of Way (ERD/1) off Wat's Dyke Way, within Wrexham Historic Park and Garden **High**	332563.1 347623.2	Medium 2.35 km	View north-west from footpath within Wrexham Historic Park and Garden. The view is of pastural fields and woodland belts located to the east of the A483, to the east of the site. Woodland located to the north and west of the footpath restricts and limits more extensive views. Part of Bryniau Clwyd a Dyffryn / Clwydian Range and Dee Valley AONB is visible in the far distance to the east. The site lies to the north-west of the residential area of Rhostyllen and A483, neither of which are discernible within the view. Open post and rail fencing bounds the footpath with adjacent individual trees. Views out from the footpath are obtained. An electricity pylon located within the adjacent open field, and the top of a pylon viewed above woodland in the middle-distance form detracting elements within this predominantly rural view. No Views of the site itself or on-site elements are obtained from this viewpoint due to intervening vegetation that limits views.
VP8: Long Lane, local road to the north. **Low**	330302.7 352985.6	Medium 1.70 km	View south from within the residential area of Brynleg. The view consists of a combination of urban residential and open grassland. This elevated viewpoint obtains extensive views south. The tops of residential properties located within Brynleg are visible above the maintained roadside hedgerow, beyond open land to the south. The view contains a mixture of agricultural farmland and urban elements that include powerlines and properties. No views of the site itself are obtained from this viewpoint due to the landform and intervening vegetation.
VP9: Public Right of Way (ESC/16) at Hookfield Farm, within AONB **High**	327190.8 350423.9	Medium 2.43 km	View from footpath within Clwydian Range and Dee Valley AONB. Extensive, elevated views are obtained to the east that include the close residential area of Coedpoeth (to the north-west), extensive open agricultural fields containing hedgerows, mature trees and woodland, the urban area of Wrexham. The site is viewed in the middle distance and forms part of an extensive area of agricultural land. Long-distance views are of urban development within Wrexham. Many pylons are present in the foreground and middle distance, located to the west of the site.

Viewpoint & Sensitivity	OS Grid Ref	Distance	View Location Description
VP10: Public Right of Way (ESC/31) within registered common land and AONB **High**	326844.4 350689.4	Medium 2.52 km	View from footpath within an area of common land within Clwydian Range and Dee Valley AONB. Extensive views to the south-east are obtained from this elevated location with open bracken and more land within the AONB in the foreground. Beyond is the residential area of Coedpoeth and agricultural land located to the east that includes the site. The agricultural land is divided by field hedgerows, hedgerow trees and small areas of woodland. Overhead cables and pylons form vertical elements within the agricultural land. More extensive long-distance views south-east are of the rising urban area of Wrexham. The view contains some natural and rural elements in close proximity but is largely influenced by the built urban development beyond.
VP11: Public Right of Way (ESC/17A) within registered common land and AONB **High**	326795.8 349198.1	Medium 3.65 km to the cable route	View from footpath within an area of common land within the Clwydian Range and Dee Valley AONB. Extensive views to the east are obtained from this elevated location with open bracken and more land within the AONB in the foreground. Beyond this view of the residential area of Coedpoeth, to the north-east are obtained along with agricultural land located to the east. The agricultural land is divided by field boundary hedgerows, hedgerow trees, small areas of woodland including linear woodland that follows the course of the River Clywedog. Overhead cables and pylons form vertical elements within the agricultural land. The site is viewed in the middle ground on low lying land located to the west of the A483. The urban area of Wrexham is viewed in the far distance rising up on elevated land further east. The view contains some natural and rural elements in close proximity but is also largely influenced by built urban development within the view.
VP12: Public Right of Way (ESC/1) to the north of the disused railway line **High**	330732.4 348753.5	Close 120m (cable route to south)	View from the footpath located to the south of the site, adjacent to the elevated disused railway line. View north across a flat open field located to the south and east of the site. A hedgerow with hedgerow trees runs along the north of the field, south of the adjacent lane (unnamed) and prohibits more extensive views south. Above the hedgerow the upper extents of vegetation located along the course of River Clywedog limits views further north. The fields within the site are screened by this vegetation (the cable route runs to the north of the hedgerow) and no views of vegetation or elements within the main part of the site are visible from this location.

Viewpoint & Sensitivity	OS Grid Ref	Distance	View Location Description
VP13: Public Right of Way (BER/3) to the east of the A483 and Bryn-moel wireless transmitting station **High**	331556.9 349718.0	Close 470m	Close view west from a break in the hedgerow (at a field gate) located along the western extents of footpath heading due west towards the B5098 - Berse Lane, A483 and the site. Views from the footpath are isolated due to vegetation along its route. This extensive view obtains close views of a farm property and vehicles traveling along the B5098 – Berse Lane located to the east of the site. Intervening vegetation screens views of the A483. Coniferous woodland in the north of the site is visible as is part of Field N. Long distance views of elevated land that forms Bryniau Clwyd a Dyffryn Dyfrdwy/Clwydian Range and Dee Valley AONB are obtained and form the backdrop to the view.

5.111 From the desk top study, Viewpoint 12 was selected to illustrate potential views from the elevated route of the disused railway, however the site visit identified that this was well vegetated, and the disused railway had limited opportunities for view out towards the development, therefor a location to the north of the disused railway was chosen.

5.112 As the baseline views for Viewpoints 7, 8 and 12 have identified there are no potential views of the site and as the nature of the Proposed Development and associated construction activities would be low level it is considered there is no potential for visual effects associated with construction activities and the completed scheme. Therefore Viewpoints 7, 8 and 12 will not be take forward to the assessment stage.

Further Visual Assessment - Residential

5.113 Within 500m of the site, an overview assessment of residential receptor groups has been completed. This anticipates in some cases the baseline view, given access restrictions and provides an overall assessment of effects upon the visual resource for Operational Phase only for these receptors. See **Appendix 5.7** for the conclusions of the Residential Visual Amenity Assessment (RVAA). To summarise, the Residential Visual Amenity Threshold would not be triggered by the Proposed Development as long as mitigation measures are implemented as shown on the Illustrative Landscape and Ecology Masterplan (**Figure 5.10**).

Public Rights of Way

5.114 There are a number of PRoWs within the study area, with two passing within the site. **PRoW BER/8** passes within the northern parcel and has open views of the whole of this parcel. In addition, views south from an elevated section of this PRoW, located within the north of the site are obtained of the northern extents of the southern parcel, located adjacent to the A525. **PRoW BER/1** passes within the southern parcel and from within the south of the site obtains views west to the adjacent area of the site. The mid-section of this PRoW located within the site, is bound on both sides by gappy hedgerows and limited filtered views of the adjacent areas of the site are obtained. From the north of this PRoW located within the site, remnants of hedgerow and individual trees located to the west of the PRoW permit views to the east of the adjacent area of the site.

5.115 Open views would be obtained where PRoW BER/1 passes within an open field, adjacent to the north of the southern parcel, to the south of the A525. The section of **PRoW BER/1** located to the

north of the A525 is bound by hedgerows and trees and obtains channelled views along its route only and would have the potential of heavily filtered views to the northern parcel only. For all other areas where PRoWs BER/8 and Ber/1 pass outside of the site existing vegetation screens views.

5.116 PRoWs obtaining medium and low visibility as identified within the ZTV include **PRoW BER/10** and **BER/11**, both located to the east of the site. Located within open fields on elevated land distant views of the western areas in the southern parcel would be filtered by intervening vegetation. Viewpoint 3 is representative of views obtained from PRoW BER/10.

5.117 Views from other PRoW's that would obtain views of the site have been considered for **PRoW ESC/16** at VP9 and PRoW ESC/31 at VP10, located within to the west of the site and identified as areas of high visibility within the ZTV.

Roads

5.118 The **A525 Rutland Road** passes between the two parcels that form the site views of the adjacent areas of the site are heavily filtered. To the north of the site, Tan Lian (road) is bound by vegetation and obtains a single view south from a field gate (Viewpoint 5). Also located to the north the B5430 is bound by hedgerows that screen views to the south. The **A483** obtains filtered views of the site where it passes adjacent to the east of the southern parcel only. Existing vegetation screens views of the site from the **Unnamed local road** that passes through Bersham.

Glint and Glare (G&G)

5.119 Due to the nature and scale of the Proposed Development, an assessment for the potential for Glint/Glare has been completed (see Pager Power Glint and Glare Report in **Appendix 5.1**). This G&G Report has been completed as a standalone report; however, the findings of the report have been reviewed and incorporated into the assessment of likely significant effects upon the visual resource within this chapter. The Pager Power Report has been modelled using the BESS Option at this stage and so does not take into account the additional solar panels option. The potential change in predicted glare is minimal and explained within the Pager Power note within **Appendix 5.1**.

5.120 The report completed by Pager Power pertains to the possible impact upon surrounding road safety and residential amenity within 1km of the Proposed Development site. It also assesses the potential for glint and glare from the Representative Viewpoints assessed within this LVIA Chapter, beyond 1km. Their sensitivity judgement is such that the majority of these views are considered to be of lower sensitivity due to their transient nature and lower safety implications as detailed from their report below:

"In Pager Power's experience, significant impacts to pedestrians/observers at ZTV viewpoints are not possible due to glint and glare effects from PV developments. The reasoning is due to the sensitivity of the receptors (in terms of amenity and safety) being concluded to be of low significance. This is because:

- *The typical density of pedestrians located at these points is low in a rural environment;*
- *Any resultant effect is much less serious and has far lesser consequences than, for example, solar reflections experienced towards a road network whereby the resultant impacts of a solar reflection can be much more serious;*
- *Glint and glare effects towards an observer are transient, and time and location sensitive whereby a pedestrian could move beyond the solar reflection zone with ease with little impact upon safety or amenity;*

- *Any observable solar reflection towards an observer would be of similar intensity to those experienced whilst navigating the natural and built environment (such as bodies of water) on a regular basis."* (Pager Power Glint and Glare Report 2023 – **Appendix 5.1**)

5.121 Therefore, this Chapter has provided some additional insight into the potential effects upon Representative Viewpoints 9, 10 and 11 only, which are within the AONB, a Nationally Designated site, using the results of the Pager Power study.

Photomontages

5.122 To illustrate the Proposed Development, two Representative viewpoint locations have been agreed with Natural Resource Wales and have been prepared as rendered photomontages of the Proposed Development (Viewpoints 10 and 11). These viewpoints were selected for photomontage to represent potential views from the AONB as requested during the consultation period. These photomontages illustrate the proposals at Winter Year 1, therefore the worst-case scenario and Winter year 15 to show any mitigation planting, see **Figure 5.9**.

Future Baseline Conditions

5.123 The WCBC LDP identifies key strategic sites and of relevance to the study area is Policy SP3: Key Strategic Housing Sites, KSS1: Land at Lower Base Farm, Ruthin Road, Wrexham that is allocated on the proposals map to deliver a residential mixed-use scheme with a minimum of 1500 homes and necessary infrastructure. This site lies to the east of the A483 and in close proximity to the Proposed Development. In addition, the proposed LDP has proposed Enabling Infrastructure Upgrades that include in Policy T6: Strategic Transport Infrastructure Improvements, and A483 Junction 3-6 upgrades.

5.124 Taking both proposals into account the future baseline assumes for the near future that residential development would be extended out further west from Wrexham and be located close to the eastern site boundary. This would slightly increase the overall level of residential development within the study area and bring it closer to the Proposed Development. In addition, the siting of the Proposed Development has been informed by potential future junction improvements. It is noted that without any future developments the future baseline would remain the same and the Proposed Development would make improvements to the future baseline through the introduction of new hedgerows, trees, woodland, scrub and meadow planting, enhancing the existing green infrastructure and landscape quality.

5.125 The Cumulative assessment for this chapter considered schemes located within the 5km study area that are currently at various stages within the planning process.

Development Description

5.126 Please refer to Chapter 2 Proposed Development Description and the Design and Access Statement for the Proposed Development description.

Alternative Layout

5.127 As described in Chapter 2: Proposed Development Description, the BESS is an integral part of the Proposed Development and has therefore been assessed as such within this ES chapter. The indicative BESS layout is shown on **Figure 2.14** – Indicative BESS Layout (Drawing no: BESS_LYT) and its components are set out in **Table 2.1** of Chapter 2: Proposed Development Description.

Construction of the BESS will take approximately 6-9 months which will be independent of the overall construction programme and will be constructed at a later date.

5.128 As detailed in Chapter 2, there is potential that development of the BESS in this location may not materialise and therefore the Proposed Development design has built in flexibility to place solar panels in this location instead. The assessment contained within this chapter has assessed the Proposed Development in the context of the BESS being included as part of the design as the worst-case scenario.

Mitigation Measures Adopted as Part of the Proposed Development

5.129 Landscape mitigation is embedded in the overall design and has been formulated in order to minimise potential landscape and visual impacts and maximise enhancement of landscape features, landscape character and biodiversity of the site.

5.130 The landscape proposals are shown on the Illustrative Landscape Plan, (**Figure 5.10**). The design has been informed by experience of similar developments and good practice guidance relating to retention and enhancement of trees and hedgerows. With the input of an ecologist where required, for example, but not limited to, when considering landscape buffers between solar panels and ecologically important retained trees or enhancement areas for specific species.

5.131 Opportunity has been taken to create new habitats by promoting the use of native species including connecting and enhancing habitats such as hedgerows, tree planting and areas set aside for biodiversity.

5.132 The landscape proposals include the following measures:

- internal and boundary hedgerow reinforcement appropriate to the arable and pastural fields that would improve the site's existing field structure, enhancing biodiversity and habitats for local wildlife and provide additional screening of the site and solar PVs within views.
- woodland edge scrub planting is proposed adjacent to existing areas of established woodland to improve connectivity and integration within the site. Areas of Ancient Woodland to be retained and protected.
- structural woodland planting is proposed for the landscape treatment, where space allows and to help screen views of the solar PVs and enhance the wooded character within the site.
- various meadow grassland mixes are proposed for different habitat creation that include a tussocky grassland for grazing beneath the solar PVs, woodland meadow for the connectivity of areas adjacent to existing woodland, wetland meadow of wet areas and a wildflower meadow.

Assessment of Construction Effects

Introduction

5.133 The timing of the Proposed Development would be dependent on securing planning permission and the discharge of planning conditions. The construction phase would be temporary and is anticipated to last for a period of approximately 12-18 months. Further details of the intended construction process are included within Chapter 2 – Construction of this ES. Construction plant on site would

include excavators and small cranes for lifting and placing the solar panels. In addition to this construction plant on site for the installation of the cable route would include JCB diggers / cable trenching machines. For full details of Construction plant and equipment see Chapter 2 - Construction Plant and Equipment **Table 2.3.**

5.134 A small amount of vegetation removal would be necessary due to the Proposed Development and would include the removal of one Category C tree in the northern parcel. Some vegetation removal would be along the cable route. Tree and vegetation protection measures would be incorporated during construction operations to protect vegetation to be retained on site. For further information refer to the Tree Survey and Arboricultural Impact Assessment (AIA) Report (**Appendix 5.8**).

5.135 Public Rights of Way BER/1 and BER/8 located within the site would remain in operation during construction, however a section may need to be temporarily closed during the installation of the cable route between the northern and southern parcels. Appropriate Health and Safety warning signs will be displayed and when deliveries are due the PRoW crossing point(s) would be manned.

5.136 During the construction phase there would be a slight increase in traffic on local roads. However, this would generally be limited to the beginning and end of the working day (construction workers arriving and leaving site) and short periods during the working day, associated with deliveries, including that of the compound facilities, PV panels, BESS and ancillary equipment.

5.137 The installation of the cable route would necessitate temporary road works where it runs beneath two local roads (un-named) located to the east of the B5426 Bronwylfa Road and the south of the site, to connect up to the existing Legacy Substation for the cable route.

5.138 The main construction access to the northern and southern parcels will utilise existing access tracks off the A525 and may necessitate some works to construct this new access but would avoid existing residential properties. Existing internal access tracks will be used for internal access within the site where possible. Temporary construction compounds will be located in both the Northern and Southern parcels with the main compound being located in the Southern Parcel.

5.139 Construction would impact the specific landscape characteristics and views of the site as described below and effects arising would be short in duration are reversible.

Potential Landscape Impacts

5.140 The potential impacts on the landscape and character during the temporary construction phase of the Proposed Development are summarised in **Table 5.12** and described below.

National Landscape Character

5.141 At a broader scale, the construction activities within the site would directly affect a very small part of the **NLCA 13: Deeside and Wrexham**. Given the location of the site, on the edge of Wrexham, it is anticipated that the construction of the Proposed Development, would cause very little change to the inherent characteristics of this NLCA. The short-term construction activities would cause a **Negligible** magnitude of impact and no more than a **Negligible Adverse** significance of effect upon the Deeside and Wrexham NLCA which is not significant.

District Level Landscape Character

Direct Landscape Effects

5.142 The short-term construction works would occur within the identified Wrexham LANDMAP LCAs: **West Wrexham Ridges and Valleys 7d, Clywedog Valleys, Plas Power and Bersham 9a and**

Rhosllanerchrugog Rhostyllen – Ruabon Penycae 7c. The construction phase of the Proposed Development would have direct effects on these LCAs, with the introduction of construction vehicles that would include small cranes and other plant. Over the period of the construction, a greater area of these LCAs would have new built form of electrical infrastructure in nature or be located next to the new built forms or disturbed by the cable installation.

5.143 However, given the containment of the landscape and the low level of construction associated with the installation of the solar panels, BESS compound and associated infrastructure, cable route and associated plant equipment, site access roads (utilising existing private roads) and temporary construction compound, awareness of the change due to the construction process would be generally confined to the immediate areas and include the two Public Rights of Way that run within part of the development.

5.144 Overall, the presence of construction vehicles and machinery used for the short-term construction works involving the installation of the solar panels and northern site access would cause a **Low** magnitude of impact to the character of **West Wrexham Ridges and Valleys 7d**, **Clywedog Valleys, Plas Power and Bersham 9a** LCAs, which are considered to be of **Low and Medium** to **High sensitivity** to this type of development respectively. This would result in a **Negligible Adverse** significance of effect on the West Wrexham Ridges and Valleys 7d LCA which is **not significant**, and **Minor Adverse** significance of effect on the on the Clywedog Valleys, Plas Power and Bersham 9a LCA during construction which is **not significant**.

5.145 The construction phase of the Proposed Development would also have direct effects on the **Rhosllanerchrugog Rhostyllen – Ruabon Penycae 7c** LCA. Construction operations within this LCA would entail the installation of the cable route to connect up to the existing Legacy Substation (for all three cable route options). Construction operations associated with the cable route would entail minor road works, some anticipated vegetation removal (see AIA Report **Appendix 5.8)** and cause some disruption in the landscape.

5.146 Overall, the presence of construction vehicles and machinery used for the temporary construction works would cause a **Medium** magnitude of impact to the character of the **Rhosllanerchrugog Rhostyllen – Ruabon Penycae 7c** LCA, which is considered to be of **Low** sensitivity to this type of development and result in **Minor Adverse** significance of effect which would not be significant.

Indirect Landscape Effects

5.147 There would be potential indirect effects during the construction phase upon the character of the identified Wrexham LANDMAP CAs: **Wrexham Town 10, Welsh Maelor 13a, Slopes to the Eastern Slopes of Ruabon Mountain 5b, Ruabon and Esclusham Mountain 1b**, where they fall within the ZTV.

5.148 The addition of elements of a transient nature through construction traffic and new plant within the Proposed Development, would be experienced from within parts of the above CAs to varying degrees. Where the construction operations (including small cranes), would be seen they would be within the context of the urban area of Wrexham. Overall, there would be the potential for short-term and indirect effect upon these LCAs.

5.149 The **Wrexham Town 10** LCA only contains two small areas on its periphery that fall within the ZTV, and it is considered the main impacts upon this LCA would be the potential increase in traffic resulting in a No Change magnitude of impact on this Low sensitivity LCA that would result in **No Change** significance of effect.

5.150 The **Welsh Maelor 13a** and **Slopes to the Eastern Slopes of Ruabon Mountain 5b** both contain isolated areas that fall within the ZTV and buffering from surrounding landscape elements resulting

in Negligible magnitude of impact on these medium sensitivity LCAs that would result in **Negligible or Minor Adverse** significance of effect which is not significant.

5.151 The **Ruabon Mountain and Esclusham Mountain 1b** is elevated, includes a large area of the ZTV and has greater intervisibility with the Proposed Development than other LCA that would be indirectly affected by construction operations. Whilst the significance of effects would be slightly higher than other indirectly affected LCAs it would still be classified as being of a Negligible magnitude of impact. Negligible magnitude of impacts on this Medium to High sensitivity LCA would result in **Minor Adverse** significance of effect which is not significant.

5.152 Beyond 5km, the potential for effects due to the construction phase upon the inherent characteristics of the landscape would be barely noticeable and considered to be No Change and therefore not significant.

Site and Immediate Surrounds

Direct effects

5.153 Construction operations associated with the installation of the solar panels within the Northern and Southern Parcels would include the removal of short sections of hedgerow to allow for the formation of internal access routes within the development. Construction operations associated with the cable route would include the excavation of a trench and would cause minor road works along two local roads (un-named) and dependent on which of the three options is selected would affect to varying degrees a small area of agricultural field.

5.154 Tree removal within the Proposed Development would be kept to a minimum and entail the removal of Tree - T264, located in the northern parcel and is a Category C tree (Category C trees are '*Unremarkable trees of very limited merit or such impaired condition that they do not qualify in higher categories* '. All trees to be retained would be protected during the works along with the adjacent areas of Ancient Woodland. See AIA Report (**Appendix 5.8**) for details. The two Public Rights of Way that will run within the Proposed Development would remain in operation during construction, however small sections may temporarily be affected when construction vehicle crossings are necessary.

5.155 Plant associated with the installation of the solar panels would include small cranes for lifting, positioning, and piling of the panels, and construction associated with the cable route would involve diggers and dumper trucks. The presence of a small amount of construction plant on site would be at complete odds with the existing character of the site. However, the character of construction operations would be relatively low key and concentrated within one area of the site at a time before construction moves on to another part of the site.

5.156 The short-term operations would occur in an area of landscape that exhibits a number of positive landscape characteristics and is considered to have **Medium** sensitivity to the change arising during construction. The proposed construction works would cause a **Medium** magnitude of impact to the existing site, resulting in a **Moderate Adverse** significance of effect on the immediate site and the immediate surrounding local area. The introduction of low-key construction activity and the new low-level built elements (solar panels) would be uncharacteristic with the attributes of the receiving landscape but not particularly locally prominent. Overall, effects are not considered significant.

Potential Visual Impacts

5.157 Visual impacts result from change to the appearance of the landscape as a result of the Proposed Development that either introduced into, or obstructs, existing views or by their overall impact on visual amenity. During the construction phase, construction activities including vegetation removal,

the use of construction machinery that includes small cranes and vehicle movements on site would be visible from the surrounding area, to varying degree where not obstructed by existing vegetation that includes woodland belts, hedgerows and mature trees. Construction activities would appear as new elements within existing views.

5.158 The majority of construction activities would be associated with the installation of solar panels within the Northern and Southern land Parcels. For this, construction would be carried out in individual areas at a time, and once the solar panels in an area have been installed, construction operations would move on to another area. As the construction phase progresses visual effects associated with the installed solar panels would increase, as more of the solar panels become potentially visible. Once the solar panels have been installed and construction has moved to another area, potential visual effects of that area would be comparable to those of the completed operational phase of the Proposed Development.

5.159 Construction activities associated with the installation of the BESS Compound would be located in the south of the southern parcel and screened to the south and west by existing mature woodland located along the Clywedog Valley. Construction activities associated with the cable route would also be carried out in individual areas at a time as detailed above for the installation of the solar panels. However once construction works have finished in an area, the area would be reinstated and there would be no above ground elements present in view (the cable route runs underground). The only potential visual difference would be in areas where any vegetation clearance has been carried out.

5.160 Views of construction activities and vehicle movements would cause disruption within the view where views are obtained, and these effects would be short term whereas the operational phase effects would be longer term but also temporary (approximately 40 years).

5.161 The scale of construction associated with the Proposed Development would be low level and entail the use of small cranes with site access provided via existing private roads to the northern and southern land Parcels. Construction associated with the cable route would affect two local roads (un-named). Awareness of the change due to the construction process would be generally confined to the immediate areas and include the two Public Rights of Way that run within part of the site.

5.162 The effects on views during construction from the 10 identified Representative viewpoint locations taken forward within this assessment, (VP 7 and VP8 and VP12 are not taken forward to the assessment see paragraph 5.109) are described below and within **Table 5.10**. The locations of the viewpoints are shown on **Figure 5.2**, with viewpoint photography shown on **Figure 5.8**. Below views have been grouped together according to their distance from the site and type of receptor.

Representative Viewpoints – within the site

5.163 The two views from within the site where construction activities occur are both located within the Southern Parcel, and along the route of Public Right of Way BER/1. Given the proximity, construction activities would be most prominent for **High** sensitivity, transient receptors at **VP2 - Public Right of Way (BER/1),** south near Bersham Conservation Area. Construction would introduce low level activities to these close-range views and would form a change to the pre-development views of agricultural land.

5.164 Walkers at VP2 would experience close views of the construction of the adjacent solar panels to the west and east respectively. Construction operations would be within the context of baseline views of agricultural fields and in the context of distant, filtered views of vehicle movements on the A483. The change in the view at this viewpoint would be short term but would significantly alter views. There would be a High magnitude of impact upon these receptors of High sensitivity, resulting in a **Major Adverse** significance of effect which is significant.

Representative Viewpoints – Close Range Views

5.165 Receptors at the other close-range viewpoints, would not be as significantly impacted during construction as receptors at VP2 (detailed above) which is located within the site and has unrestricted views. Locations at **VP1 - Public Right of Way (BER/1), VP3 - Public Right of Way (BER/10), VP13 Public Right of Way (BER/3), VP4 - Plas Buckley Road and VP5 - Tan Lian** are close to the site, not particularly elevated and intervening vegetation provides a good amount of screening. Close range views of construction operations would be obtained from walkers of high sensitivity at VP1, VP3 and VP13 and occupiers of vehicles of Low sensitivity at VP4 and VP5.

5.166 Within close range views, the wider urban edge setting of the Proposed Development within fringe areas of Wrexham is apparent within baseline views. The topography of the site, its surrounding areas and existing vegetation within and along the site boundaries restricts views.

5.167 Whilst VP3 and VP13 would be located close to construction activities; existing boundary vegetation would filter views and construction operations and construction would only be visible when operations are being carried out within adjacent areas of the Proposed Development. Existing vegetation to the north of the A525 would screen views of operations with the Northern Parcel. Construction operations would not significantly alter views and there would be a Low magnitude of impact upon these receptors of High sensitivity, resulting in a **Minor Adverse** significance of effect on walkers, which is not significant.

5.168 Views of construction activities available to occupiers of vehicles at VP4 and VP5 would be filtered by existing boundary vegetation and construction would only be visible when operations are being carried out within adjacent areas of the site. Views of operations within the east of the Southern Parcel, would be obtained from VP4 and construction within the Northern Parcel, only would be obtained by receptors at VP5. Construction operations would not significantly alter views and there would be a Low magnitude of impact upon these receptors of Low sensitivity, resulting in a **Negligible Adverse** significance of effect on occupiers of vehicles, which is not significant.

Representative Viewpoints – Medium Range Views

5.169 The existing agricultural setting on the edge of the urban area of Wrexham is apparent within all medium range representative views selected for this assessment. Medium range views include walkers at **VP6 - Public Right of Way (BER/11), VP9 - Public Right of Way (ESC/16), VP10 - Public Right of Way (ESC/31) and VP11 Public Right of Way (ESC/17A).** These are all located on elevated land to the west of the development and Wrexham.

5.170 Views of construction activities would include distant views of the urban edge setting to varying degrees. The urban edge setting would be most visible within views from VP9, VP10 and VP11 which are located furthest from the site and are all located within the AONB. Views of construction activities from VP6 would be the closest however, this is balanced by greater amounts of vegetation filtering views that is comparable to greater areas of construction falling within views from VP 9, VP10 and VP11, albeit in the distance. For receptors at all four viewpoints, construction activities would form a small distant element within the overall view and would be carried out in individual areas at a time as detailed above. Construction activities would result in a Negligible magnitude of impact upon these receptors of High sensitivity, resulting in a **Minor Adverse** significance of effect which is not significant in EIA terms.

Representative Viewpoints – Long Range Views

5.171 Given the maximum height of 3.9m (BESS - Twin MV Skid) of the infrastructure within the Proposed Development, no long-distance views have been included for the purpose of this assessment.

Alternative Layout

5.172 In the event that the BESS is not built out and this land is used for additional solar panels instead, the landscape and visual effects would be equal to or less than those currently presented in this chapter given that the BESS elements are more prominent features within the overall Proposed Development. The Glint and Glare effects of the alternative layout have been assessed at paragraph 5.260.

5.173 As a result, this assessment currently presents a worst-case scenario (in respect of landscape and visual effects, excluding Glint and Glare) and therefore allows the flexibility for either option to be brought forward in the future.

Further Mitigation

5.174 Proposed planting included in the Landscape Strategy (see **Figure 5.10**) for the Proposed Development will be incorporated during the latter phases of construction as it would be likely to be damaged by construction activity. No further mitigation is proposed.

Future Monitoring

5.175 Landscape management would be required for a period of five years following completion of the Proposed Development so that the newly planted and seeded areas become well established and meet their landscape potential. Management would include the replacement of dead, dying, or damaged stock or those that fail to establish satisfactorily. Maintenance that would be beneficial for plant growth, form and plant health would be promoted. Hedgerows would be managed to a height of 3 m, whilst specimen trees would be allowed to grow taller.

Assessment of Operational Effects

5.176 This section considers the landscape and visual effects of the completed development during the operational phase at Winter Year 1 and Summer Year 15.

5.177 As already detailed, the site is part agricultural land, containing field boundary hedgerows, two Public Rights of Way, with areas of Ancient Woodland in the south (Southern Parcel) that also form part of the Plas Power Estate. The overall condition of the site is Medium.

5.178 The Proposed Development would consist of solar panels, also known as (PV) attached to metal frames that comprise of multiple rows of solar panels running east to west. In addition, inverters, transformers and switchgear, monitoring house, access routes, BESS Compound and an underground cable route would link up to an existing substation located to the south-west of the development.

5.179 The removal of small sections of hedgerow would be necessary to accommodate the access routes within the Proposed Development (see AIA Report (**Appendix 5.8**)) and no other on-site elements would be affected. The introduction of the proposed solar park would create a (subtly) distinguishable new built element within the existing agricultural urban fringe setting of this part of the study area. Hedgerow improvements including gapping up and the planting of hedgerow trees, individual semi-mature tree planting, woodland edge shrub planting and a variety of different grasslands and meadow mixes are proposed to replicate those found within the surrounding landscape.

5.180 A landscape strategy has been developed and the Illustrative Landscape and Ecology Masterplan is shown on **Figure 5.10**. The use of native shrubs and grassland would help provide a link with the

existing woodland habitats and help to maintain a buffer between the Proposed Development. The planting would soften and screening to the proposed solar panels within views from the local area once established.

Potential Landscape Impacts

5.181 The likely effects on the landscape and character during the operational phase at winter Year 1 are set out in **Table 5.12** and described below.

National Landscape Character

Winter year 1 and Summer Year 15

Direct effects

5.182 As detailed above for construction operations the completed scheme would directly affect a very small part of the **NLCA 13: Deeside and Wrexham** and it is considered the completed scheme at Winter year 1 would continue to cause a **Negligible** magnitude of impact and no more than a Negligible Adverse significance of effect, which is not significant. This would also be the same for summer year 15. This is **not significant**.

District Level Landscape Character

Winter year 1 and Summer Year 15

Direct Effects

5.183 There would be direct long-term (40 years), effects upon the identified Wrexham LANDMAP LCAs: **West Wrexham Ridges and Valleys 7d and Clywedog Valleys, Plas Power and Bersham 9a** LCAs, at winter Year 1. Areas of open agricultural land would now form part of a solar scheme (Northern and Southern Parcels), that would form a change in use and character to a small part of the overall LCAs that the development would be located within.

5.184 The existing field structure in the south-west of the Northern Parcel would be altered by the removal of a post and wire fence to combine two fields into one. However, improvements to the existing field structure would be provided in this area by the replacement of an existing post and wire fence with a hedgerow containing hedgerow trees. This would provide ecological benefits by connecting two areas of woodland, provide visual screening within the site and would improve the field structure. Areas of new woodland and woodland edge planting and new landscape enhancement areas would be introduced.

5.185 Effects for winter Year 1 associated with the completed Proposed Development would be more significant than during construction phase as the completed scheme would form a more significant, long-term element within the landscape than the temporary low key construction operations within these LCAs. The introduction of low-level solar panels, BESS Compound and associated plant within the site (the Northern and Southern Parcels) that is contained by mature hedgerows in the north and woodland to the south would have a **Low** magnitude of impact on the overall character of both LCAs.

5.186 Direct effects on the **West Wrexham Ridges and Valleys 7d** LCA that has been influenced by its proximity to Wrexham, has a **Low** sensitivity and a **Low** magnitude of impact would cause a **Negligible or Minor Adverse** significance of effects, which is **not significant**.

5.187 The **Clywedog Valleys, Plas Power and Bersham 9a** LCA includes part of the Plas Estate and has historical associations located along the route of the River Clywedog. This LCA has a **Medium**

sensitivity, and a **Low** magnitude of impact would cause a **Minor Adverse** significance of effect on this LCA. Neither would be significant. The establishment of the landscape planting scheme, within the Proposed Development by summer Year 15 would help integrate the development into the landscape and direct impacts would be slightly reduced but would remain similar to year 1 effects, which is **not significant**.

5.188 There would be some limited direct effects upon **Rhosllanerchrugog Rhostyllen – Ruabon Penycae 7c** at winter Year 1, due to the location of the cable routes to the south of the solar scheme (the Northern and Southern Parcels). Although construction activities would have installed replacement surfacing where the cable route runs along the road, and grass where the cable route runs within agricultural land, evidence of this change would still be just noticeable at winter Year 1. Although these areas would have been recently reinstated, there would be very limited adverse impacts on the character of this LCA. Whilst the cable route forms part of the development it runs underground and therefore would have a Negligible magnitude of impact and **Negligible or Minor** adverse significance of effect on this LCA at winter Year 1, which is **not significant**.

5.189 By Summer year 15 long term (40 years) effects associated with the adjacent solar scheme (Northern and Southern Parcels) would have very limited influence over the **Rhosllanerchrugog Rhostyllen – Ruabon Penycae 7c.** The establishment of the landscape planting scheme within the Proposed Development by summer year 15 would help integrate the development into the landscape and evidence of the cabling would be not discernible, reducing potential effects to No Change. Effects are **not significant.**

Indirect Effects

5.190 There would also be limited indirect, long-term (40 years), effects upon the **Rhosllanerchrugog Rhostyllen – Ruabon Penycae 7c** and the **West Wrexham Ridges and Valleys 7d** at winter Year 1 through potential perceptual impacts of the Proposed Development from limited areas of the LCA, where there would be the potential to see the Proposed Development (see **Figure 5.5**). Potential effects would be in line with those listed above.

5.191 Indirect effects associated with the Proposed Development on the adjacent LCAs include, **Wrexham Town 10, Welsh Maelor 13a, Eastern Slopes of Ruabon Mountain 5b** and **Ruabon and Esclusham Mountain 1b.** The level of operational effects would slightly increase compared to the construction phase as the completed scheme would form a long term, uniform and more extensive element of development within the landscape than the temporary, low key construction operations. The increase in impacts would not be of such a significance that the overall effects score is altered from that represented during construction. There would be a **Negligible** magnitude of impact upon these LCAs. For **Eastern Slopes of Ruabon Mountain 5b** and **Ruabon and Esclusham Mountain 1b** (within the AONB), which are considered to be Medium to High sensitivity, there would be a **Minor** adverse significance of effect on this LCA, which is not significant**.** The other LCAs due to their lower sensitivity, would have a significance of **Negligible or Minor** Adverse during winter Year 1. The establishment of the landscape planting scheme within the Proposed Development by summer Year 15 would help integrate the development into the landscape. Indirect impacts would be slightly reduced but would remain similar to year 1 effects. Effects are not significant.

Site and Immediate Surrounds

Winter year 1 and Summer Year 15

Direct effects

5.192 The Proposed Development would result in the long-term (40 years) change of use of areas of agricultural field to a solar scheme comprising of solar panels, security fencing, associated plant and

internal access roads. A BESS Compound would be located in the south of the development (Southern Parcel), adjacent to the north of the River Clywedog and existing mature woodland. The solar panels would be elevated 3m above ground level and sheep grazing would continue throughout the site.

5.193 The existing hedgerows within the site would be protected and enhanced where appropriated through additional maintenance and maintained throughout the Proposed Development. The removal of short sections of hedgerow to accommodate the development would be reduced as far as practicable to maintain the existing field pattern. Appropriate buffers to the areas of Ancient Woodlands in proximity to the site have been provided. There would be minimal vegetation removal to allow for the Proposed Development and retained vegetation would be protected and enhanced where appropriate through management (refer to **Figure 5.8** AIA Report).

5.194 The implementation of a soft landscape scheme throughout the Proposed Development would incorporate hedgerow improvements that would include bulking up sparse areas and additional hedgerow tree planting. This would enhance the existing hedgerow integrity and structure within the development. The proposed landscape and ecological enhancements are shown on **Figure 5.10** and listed above in Para 5.119.

5.195 The routes of the two Public Rights of Way that lie within the Proposed Development would be maintained.

5.196 There are no designations of landscape importance within the site that would be affected by the development. The retention of existing boundary vegetation would help maintain the integrity of their setting and reduce intervisibility with the Proposed Development and retain the existing landscape field structure.

5.197 The topography of the site would remain unchanged with the exception of minor works to form internal access routes and hard standing areas for the location of the substation and associated infrastructure. Minor modifications to the existing field drains would be necessary and this would not affect the function of external watercourses network.

5.198 Overall, the development would cause a **Medium** magnitude of impact to the character of the site of **Medium** sensitivity and result in **Moderate Adverse** significance of effect which is not significant within this topic chapter.

5.199 By Year 15 the establishment of the landscape scheme that would include hedgerow improvements, areas of woodland and scrub planting, and wildflower grassland creation to improve species diversity and the ecological value of the area. This would help integrate the Proposed Development into the landscape and create recreational and education opportunities through the incorporation of interpretation boards promoting the ecological benefits and providing information on the former use and history of the Plas Estate. In addition, provision for informal amenity in the area in the north would promote the use of Public Rights of Way BER/1 and BER/8. The magnitude of impact on the character of the site would reduce to **Low** and result in a **Minor adverse** effect that would be fully reversible in the long-term following the return of the site to full agricultural use. This is not significant.

Potential Visual Impacts

5.200 Potential effects upon the visual resource during the operational phase of the Proposed Development includes an assessment at Winter Year 1 (a worst case) and at Summer Year 15, when proposed planting would have achieved its intended design and mitigation functions. The locations of the 10 viewpoints taken forward are shown on **Figure 5.2,** with viewpoint photography shown on **Figures 5.8** and photomontages for VP10 and VP11 shown on **Figure 5.9**. Visual effects at Winter year 1 as a result of the completed development within the northern and southern Parcels

would be more significant than during the construction phase. This has been concluded by taking into consideration vehicle movements and construction activities that would be more visually discordant in the view than the completed scheme however, this is offset by the short duration. The completed scheme would form a more significant visual element within the landscape than the short-term, low-key construction operations within views.

Representative Viewpoints – within the Site

5.201 Views from within the Proposed Development would be gained by walkers at **VP2 - Public Right of Way (BER/1),** near Bersham Conservation Area and located within the Southern Parcel and on the route of Public Right of Way BER/1. Given the close proximity of the Proposed Development to this receptor and the nature of the Proposed Development any change experienced due to the solar farm would be most prominent in views from this location. The Proposed Development would introduce a solar farm into close-range views, changing the pre-development views of agricultural land.

5.202 Walkers at VP2 have a high sensitivity and views at completion Year 1 would be transient. Views obtained from this stretch of footpath would be of the adjacent solar panels located within Field Q in the foreground. These would occupy the full view and prevent longer distance views of fields beyond and vehicles travelling on the A483 obtained at baseline. The landscape proposals that include the re-establishment of hedgerows along the east of this footpath, would be newly planted and provide no screening of the solar scheme. The solar panels would form a new, dominant feature within views and obscure more distant views.

5.203 The overall nature of the view would be significantly altered. The change in the view would be long term but reversible and alter the scale and character of the wider setting of the Public Right of Way. There would be a High magnitude of impact upon this receptor of High sensitivity, resulting in a **Major Adverse** significance of effect at winter Year 1, which is considered to be significant.

5.204 By Summer Year 15 the establishment of a new hedgerow planted along the east of the Public Right of Way would create a green corridor along the route of the footpath. Views of the solar panels to the west, visible at completion winter Year 1, would now be screened by the hedgerow at summer Year 15 and no views of the adjacent areas of development would be obtained from this VP. There would be a change in the view from open views across pastoral farmland containing field boundary hedgerows, to channelled views along a green corridor. Negative impacts associated with the closing down of views would be partially offset by channelled views along the green corridor that incorporates hedgerow reinstatement and wildflower grassland. The loss of openness of the view due to the new obstruction by the hedgerow would remain a noticeable change to the pre-development view, although not completely out of character. There would remain a Medium magnitude of impact resulting in **Moderate Adverse** significance of effect at summer Year 15, which would be long term but fully reversible, and not significant.

Representative Viewpoints – Close Range Views

5.205 Close range views at winter Year 1 obtained by High sensitivity, transient walkers at **VP3 - Public Right of Way (BER/10) near scheduled monument and VP13 Public Right of Way (BER/3)** of the Proposed Development would be of small areas of the nearby area of land within the Southern Parcel. Filtered views of the adjacent solar panels obtained from both VPs would be obtained above existing boundary hedgerows. Vegetation located to the north of the A525 would continue to screen views of Proposed Development within the Northern Parcel from both VPs. There would be a Low magnitude of impact and a **Minor or Moderate Adverse** significance of effect upon the views from both close-range views, which is not significant.

5.206 By summer Year 15 improvements to boundary hedgerows that includes individual tree planting would help to screen and break up view of the solar panels and would result in a **Minor Adverse** significance of effect, which would be long term and fully reversible and not significant.

5.207 Walkers at VP1 have a High sensitivity and views at completion in Year 1 would be transient. Views of the solar panels located in the west of the development, would be visible in the distance beyond the adjacent open field to the west and would occupy a small part of the middle-distance view. The landscape proposals that include the re-establishment of hedgerows along the west of this footpath, would be newly planted and provide no screening of the solar scheme. The solar panels would form a new, distant feature within views and obscure longer distant views.

5.208 The overall nature of the view would be slightly altered. The change in the view would be long term but reversible and alter the character of the wider setting of the Public Right of Way. There would be a Medium magnitude of impact upon this receptor of High sensitivity, resulting in a **Moderate Adverse** significance of effect at winter Year 1, which is considered to be significant.

5.209 By summer Year 15 hedgerow improvements would have matured and would screen the visibility of the development for receptors at VP1. There would be a loss of openness of the view to the west due to the hedgerow that would be a noticeable change to the pre-development view. This would not be completely out of character and effects would be **Minor Adverse,** which would be long term and fully reversible and not significant.

5.210 Close range, elevated views experienced by Low sensitivity people traveling in vehicles would include locations at **VP4 - Plas Buckley Road**, located to the north of the development (Southern Parcel) and **VP5 - Tan Lian, local road**, located to the west of the development (Northern Parcel). At completion winter Year 1 views of the Proposed Development would be obtained from both viewpoints located on roads. Transient views of the Proposed Development would be seen beyond agricultural fields and filtered by boundary vegetation. Views of solar panels located in a small area in the south-west of the Southern Parcel would be obtained from VP4 and solar panels in the west of the Northern Parcel would be obtained by receptors at VP5. Whilst views at VP5 would be slightly more open as there is a small gap in the boundary hedgerow, the magnitude of impact would be the same for receptors at both VPs. There would be a Low magnitude of impact and a **Negligible or Minor Adverse** significance of effect upon occupiers of vehicles in close-range views, which is not significant.

5.211 By summer Year 15 hedgerow improvements would have matured and would screen the visibility of the Proposed Development. There would be a Negligible magnitude of impact and a **Minor Adverse** significance of effect

Representative Viewpoints – Medium Range Views

5.212 Due to the elevated locations more of the Proposed Development falls within the view than for some of the close-range views. However, views are more distant and occupy a small area within the wider view. Although the Proposed Development would cause some minor obstruction to the views and the introduction of new elements would be noticed, the overall composition of the views would be similar to the pre-change circumstances or would only represent a slight change to the baseline.

5.213 Medium range views experienced by High sensitivity, transient walkers include **VP6 – Public Right of Way (BER/11), VP9 – Public Right of Way (ESC/16), VP10 – Public Right of Way (ESC/31)** and **VP11 Public Right of Way (ESC/17A),** VP9, VP10 and VP11 which are located with the AONB. All four receptors are located within an area of elevated land to the west of the Proposed Development and have extensive views across low lying areas of the study area to the north-east.

5.214 VP6 is located closest to the development and receptors however, the extent of the overall Proposed Development area within the view would be smallest and include solar panels in the north-east of the Southern Parcel. Views of the Proposed Development would be heavily filtered. Walkers at VP9 would obtain filtered views of a greater extent of the Proposed Development located within the Southern Parcel and a small area of solar panels in the east of the Northern Parcel. Walkers at VP10 and VP11 would obtain views to parts of the Proposed Development, however these would be located furthest from the site. Photomontages at **Figure 5.9** produced for VP10 and VP11 illustrate potential views from these locations at completion winter Year 1 and winter Year 15.

5.215 Whilst the nature of individual views from medium range viewpoints differs slightly, as identified above, it is considered the overall impacts would be comparable for all four receptors. These High sensitivity receptors would experience a Low magnitude of impact and a **Moderate Adverse** significance of effect which is not considered to be significant within this topic chapter.

5.216 By summer Year 15 hedgerow improvements would have matured and would slightly reduce the visibility of the Proposed Development. There would be a Negligible magnitude of impact and a **Minor Adverse** significance of effect upon the views from all three medium-range locations.

Residential Receptors (High Sensitivity)

5.217 The Proposed Development would be discernible within available views from residential receptors within the study area. Refer to the Residential Visual Amenity Assessment **Appendix 5.7** for details of visual effects on Residential receptors.

5.218 The RVAA assessment concluded that the Proposed Development would not trigger the Residential Visual Amenity Threshold in relation to the visual amenity or liveability of any of the residential properties within the study area, so long as the mitigation proposals suggested are implemented (as shown on **Figure 5.10**) and managed to fulfil their designed intention. This property is rented but within the ownership of the landowner of the Proposed Development site. Within the RVAA assessment there would be significant effects upon one property at winter Year 1 but by summer Year 15, once all mitigation has matured, there would be no significant effects upon this receptor.

Public Rights of Way (High Sensitivity)

5.219 The Proposed Development would be discernible, to varying degrees, within available views from PRoWs within the study area. PRoW BER/1 runs through the site and two Representative viewpoints are located along this route and form part of the assessment. Refer to VP1 and VP2 for details of visual impacts on walkers using this PRoW (See para 5.198-5.203). PRoW/8 also runs through the northern Parcel and effects would be comparable to those described for VP1 and VP2. Other PRoWs within the immediate surroundings include BER/10 represented by VP3 and BER/11 represented by VP6.

Roads (Low Sensitivity)

5.220 Existing vegetation would continue to screen views of the development from the unnamed local lane that runs through Bersham and the B5430. Views from the A525 would be heavily filtered and views of the Proposed Development would be barely noticeable for people travelling in vehicles, glimpsed views only when driving on rising ground on the approach to Coedpoeth on the right-hand side of the vehicle mostly perpendicular to travel. Views from the A483 would be transient and north bound vehicle travellers would obtain views of the Proposed Development where boundary vegetation is sparse. Views would be fully screened by the mitigation design by summer Year 15.

Alternative Layout

5.221 In the event that the BESS is not built out and this land is used for additional solar panels instead, the landscape and visual impact (excluding Glint and Glare) effects would be equal to or less than those currently presented in this chapter given that the BESS elements are more prominent features within the overall Proposed Development. As a result, this assessment currently presents a worst-case and therefore allows the flexibility for either option to be brought forward in the future.

Further Mitigation

5.222 The Proposed Development incorporates an indicative landscape and ecology strategy that is included as an integral part of the design (**Figure 5.10**) and would be implemented as part of the proposals. No additional mitigation requirement has been identified.

Future Monitoring

5.223 Landscape management would be required for a period of five years following completion of the Proposed Development so that the newly planted and seeded areas become well established and meet their landscape potential. Management would include the replacement of dead, dying or damaged stock or those that fail to establish satisfactorily. Pruning that would be beneficial for plant growth, form and plant health would be promoted.

5.224 Hedgerows would be managed to a height of 3 m, whilst specimen trees would be allowed to grow taller. Additional management of local existing woodlands within ownership of the landowner and in proximity to the site is recommended (see AIA Report (**Appendix 5.8**)).

Accidents/Disasters

5.225 With respect to landscape and visual matters, potential accidents/disasters relevant to the Proposed Development are unlikely. There is a potential risk of introduced diseases affecting vegetation, for example Ash dieback. As a precautionary measure Ash would not be specified within proposed planting mixes.

Potential Changes to the Assessment as a Result of Climate Change

5.226 Any future climatic changes are unlikely to affect the Landscape and Visual Assessment for the Proposed Development. Should appropriate landscape management, in the form of additional or alternative planting and further management of the woodland areas within the immediate local context of the site be implemented, any landscape and visual effects are likely to be marginally less than the levels reported in this chapter.

5.227 The Illustrative Landscape and Ecology Masterplan utilises appropriate species and incorporates climate change considerations, such as drought tolerance, in the species selection for the design (see **Figure 5.10**). This can be further developed at the detailed design stage.

Assessment of Decommissioning Effects

5.228 Predicted effects upon the landscape and visual resource during the decommissioning of the Proposed Development would be equivalent to those experienced during construction for the duration of the phase, with the small exception of the proposed vegetation having reached maturity which would offer some limited screening of low-level works within the localised views. The decommissioning of the Proposed Development is not anticipated to cause any significant effects

upon the landscape or views. Significant effects proposed upon VP1 and VP2 during construction would be reduced to not significant due to mitigation planting having reached maturity and being retained beyond decommissioning offering screening to proposed works.

5.229 Assuming the Proposed Development is fully removed, and the site restored to cleared ground for grazing and crop growing, this would slightly open up the local views as due to the removal of the built elements. Where appropriate, planting and grassland would be protected during removal of the Proposed Development. Hedgerows within specimen trees and enhance existing hedgerows would remain in place and managed, continuing to retain a good landscape structure appropriate to the local landscape character. New woodland planting and management would continue to offer some landscape improvements to the local landscape condition.

5.230 There would be no significant effects upon the landscape or visual resource during decommissioning.

Assessment of Cumulative Effects

5.231 The assessment of cumulative effects assesses the effects associated with the Proposed Development together with other developments. The significance of cumulative effects on the existing landscape character and visual resources of the Proposed Development with other schemes that are allocated, consented or for which planning permissions are currently being sought within a 5 km radius of the Proposed Development has been assessed. The assessment also includes proposed developments for which it can be determined are reasonable likely to come forward (e.g., those for which Scoping Reports have been submitted.

5.232 **Appendix 4.7** provides details of the Cumulative Schemes considered and their locations are illustrated on drawing JPW1473-DNS-007. The list of developments included in the cumulative assessment are set out in **Table 5.11.**

Table 5.11: Cumulative Developments considered in the Assessment of Effects on Landscape and Visual Resource

Ref	Cumulative Schemes	Distance from the site	Potential effects
Permission Granted			
1	**Legacy Substation** Legacy National Grid Station, Bronwylfa Road, Talwrn, Wrexham Installation and operation of battery storage facility and ancillary development at the Legacy National Grid Substation to provide the proposed point of connection for the Plas Power Solar Farm. **P/2023/0175** Granted 24/07/23	110 - 260m To the cable route (dependent on cable route option)	Within Rhosllanerchrugog Rhostyllen – Ruabon Penycae LCA 7c. Battery storage facility at Legacy National Grid Substation. Facility would not be viewed in combination with proposal from Representative viewpoints.
Pending Determination			
2	**Land South of Berse Road** Land South of Berse Road, Caego, Wrexham Residential development of 47 dwellings with associated access, landscape and open space.	540m	Within West Wrexham Ridges and Valleys – 7d LCA. Residential development comprising 47 properties and amenity space. A small number of receptors introduced to urban fringe area and would be

Ref	Cumulative Schemes	Distance from the site	Potential effects
	P/2023/0221		distinguishable from a small number of Representative viewpoints.
Pre-Application			
3	**Bersham Energy Plant** A 30 MW energy plant and reclamation scheme currently at the pre-application stage. **DNS/3237973**	110 - 260m To the cable route (dependent on cable route option)	Within Rhosllanerchrugog Rhostyllen – Ruabon Penycae LCA 7c. Energy Plant (maximum height 21m) would adjoin an existing small industrial area adjacent to the A483.
Pre-Application Consultation			
4	**Lower Berse Farm** Lower Berse Farm, Ruthin Road (A525), Wrexham Proposed development for a new community-led neighbourhood, delivering in the region of 1,500 homes on a site allocated for housing in the WCBC emerging LDP.	50m	Within West Wrexham Ridges and Valleys LCA 7d. Residential development comprising 1,500 properties, school and community facilities. A large number of residential receptors introduced to urban fringe area and would be distinguishable from a number of Representative viewpoints.
5	**Land South of Bersham Road** Legacy National Grid Substation, Bronwylfa Road, Talwrn, Wrexham Currently in public consultation for a proposed Energy Storage System to be connected to the existing legacy substation.	**0-190m** To the cable route (dependant on cable route option)	Within Rhosllanerchrugog Rhostyllen – Ruabon Penycae LCA 7c. Energy storage system to connect to nearby Legacy National Grid Substation.

Cumulative Landscape Effects

5.233 All five cumulative schemes are located within the 5km study area, within the same NCA as the Proposed Development (13 Deeside and Wrexham), and within two of the LCA that the Proposed Development is located within. As there is no potential for significant cumulative effects on the NCA, this cumulative assessment considers effects on LCAs only. In addition, none of the cumulative schemes are located within LCA 9a it is considered indirect construction and operational effects to this LCA would not be of a significance to raise cumulative effects above those identified for the Proposed Development, and so this will also not be considered further within this cumulative assessment.

5.234 Cumulative schemes 2 and 4 are located within the **Clywedog Valley, Plas Power and Bersham LCA - 7d** that houses the whole of the Northern Parcel, and the majority of the Southern Parcel of the Proposed Development. Cumulative schemes 1, 3 and 5 are located within the **Rhosllannerchrugog Rhostyllen – Ruabon Penycae LCA – 7c** which also includes the cable route.

5.235 The five cumulative schemes considered as part of the cumulative assessment are at various stages of the planning approval process; with one granted approval (Ref 1, within above **Table 5.11**), one pending decision (Ref 2), one at pre-application stage (Ref 3) and two at pre-application consultation stage (Ref 4 & 5). This cumulative assessment assumes the worst-case scenario, being all five cumulative schemes are implemented comprising two energy storage schemes (Ref 1 and 5), an energy plant (Ref 3) and two residential schemes (Ref 2 and 4).

5.236 **Appendix 4.8** - Cumulative Schemes has identified within the development timeline that the Legacy Substation (Ref 1) is likely to be in operation during the construction of the Proposed Development. However, it is likely that the construction period for the four other cumulative schemes are likely to overlap to some extent resulting in cumulative temporary effects on landscape character. The Proposed Development would cause Negligible adverse significance of construction effects upon both **West Wrexham Ridges and Valleys LCA - 7d** and **Rhosllanerchrugog Rhostyllen- Ruabon Penycae LCA - 7c** respectively. It is considered that the cumulative effects of the construction phase of the Proposed Development in-combination with the cumulative schemes would result in a Minor or Moderate adverse significance of cumulative effect during construction upon both **LCA 7d** and **LCA 7c**, which is not significant in EIA terms. This increase in potential landscape effects would be predominantly due to the sizable Lower Berse Farm residential scheme and its anticipated longer term for construction and additional plant requirements.

5.237 If all cumulative schemes were fully built out, they would intensify the built form of residential development and energy storage infrastructure on the fringe of Wrexham within the study area. Permanent effects on the urban fringe of Wrexham within the study area would occur as a result of the cumulative effects of these cumulative schemes together with the reversible, long-term (40 years) effects of the Proposed Development. The Proposed Development on its own would cause Negligible or Minor adverse significance of effect upon **West Wrexham Ridges and Valleys - LCA 7d** as a whole at both winter Year 1 and summer Year 15. There would be Negligible or Minor adverse at winter Year 1 and No Change at summer Year 15 on **Rhosllanerchrugog Rhostyllen-Ruabon Penycae - LCA 7c**, as this LCA would be fully reinstated following the installation of the cable route forming part of the Proposed Development, and there would be very limited opportunities to visually experience the Proposed Development from within this LCA. The in-combination effects of the cumulative schemes in association with the Proposed Development would increase the overall level of built development within both LCAs. Ref 4 would essentially incorporate this previously farmland and urban fringe area of **LCA 7d** into the townscape of **Wrexham Town - LCA 10** and under permanent residential use. This would, in-combination with the long-term reversible Proposed Development, create a greater magnitude of change upon the landscape character of **LCA 7d**, and would result in a **Moderate** adverse significance of cumulative effect, which is not significant. The urban fringe context would be intensified and slightly increased, but not significantly altered.

5.238 There would be potential indirect in-combination effects upon the landscape character of those LCAs within the AONB (**Slopes to the Eastern Slopes of Ruabon Mountain LCA 5b** and **Ruabon and Esclusham Mountain LCA 1b**). Experiencing the potential cumulative changes would be restricted to only those parts of the LCAs within the ZTV of the Proposed Development when overlaid with potential intervisibility with the cumulative scheme, essentially the areas on higher ground facing east, where views are available from within the LCAs towards the urban settlements of Coedpoeth and Wrexham. It is anticipated that the in-combination magnitude of change at construction, operational winter Year 1 and summer Year 15 would be slightly more than when considering impacts of the Proposed Development in isolation. The Proposed Development would not be the main contributor to this potential effect due to its low-lying nature and reversibility. The increase in potential effects however would not be sufficient to raise the cumulative significance of effect above the significance of potential landscape effects of the Proposed Development in isolation during construction, winter Year 1 and summer Year 15 at **Minor** adverse, which is also not significant. It is also not considered that the introduction of the Proposed Development within available views would cause a sense of urban encroachment towards the AONB.

5.239 Overall, it is considered that the study area has the capacity to absorb the cumulative schemes and the Proposed Development without any significant cumulative effects on landscape character during both its construction and operational phases.

Cumulative Visual Effects

5.240 As aforementioned, the Legacy Substation (Ref 1) is likely to be in operation during the construction of the Proposed Development and would therefore have no potential construction cumulative visual effects. There would be varying degrees of visual effects during construction associated with the other four cumulative schemes. The residential development at Lower Base Farm (Ref 4) has the potential for the most significant in-combination visual effects of the four cumulative schemes due to its scale and proximity to the Proposed Development.

5.241 There would be no cumulative views during construction upon the existing view from Representative viewpoints 1, 3, 4, 5, 7, 8 and 12 and therefore no significant cumulative effects on these receptors, when looking in the direction included for this LVIA Chapter i.e., towards the Proposed Development. There would be **Major** adverse significant effect during the construction phase upon the view within the Proposed Development site from Representative Viewpoint 1 during construction due to the Proposed Development as detailed within the visual impacts assessment Section, which is significant.

5.242 Within the views from Representative Viewpoint 6, views of the Lower Berse Farm (Ref 4) cumulative scheme only in combination with the Proposed Development would be available. These cumulative effects upon the view would slightly increase the overall level of construction effects from that due to the Proposed Development in isolation. However, these would not be sufficient to raise the cumulative significance of effect above the significance of effect of the Proposed Development in isolation during construction. It would remain Minor adverse for Viewpoint 6, which is not significant in EIA terms. Cumulative effects upon these views would be predominantly due to the closer Proposed Development.

5.243 Views of the construction of the two residential cumulative schemes (Ref 2 and 4) would be obtained from Representative viewpoint 2, with Plas Power Wood screening views of the construction of all other cumulative schemes (located to the south). As detailed above, these cumulative effects would slightly increase the overall level of construction effects from those effects due to the Proposed Development in isolation, but would not be sufficient to raise the cumulative significance of effect above the significance of effect of the Proposed Development in isolation during construction, which is **Major** adverse and is significant. Cumulative effects upon this view would be predominantly due to the closer proximity of the Proposed Development in comparison to the two residential schemes.

5.244 Users of Representative viewpoints 9, 10 and 11 (all within the AONB) have the potential to view the construction of all four cumulative schemes in association with the Proposed Development, which would slightly increase the overall level of construction effects upon these views over and above that of the Proposed Development in isolation. However, this would not raise the cumulative significance of effect above the significance of effect of the Proposed Development in isolation of **Minor** adverse for all three views. It is considered these construction cumulative effects would broadly be equally proportioned between the cumulative schemes and the Proposed Development.

5.245 Representative Viewpoint 13 is located within the Lower Berse Farm residential cumulative scheme (Ref 4) and cumulative effects associated with this scheme in association with the Proposed Development would significantly increase the overall level of construction effect upon this view to **Major** adverse during construction, which is significant; the Lower Berse Farm residential cumulative scheme being the greater contributor to this significant cumulative effect due to its proximity to the receptor. This is an increase from Minor adverse for construction effects for the Proposed Development in isolation.

5.246 As detailed above for the construction phase, there would be no combined cumulative views at winter Year 1 and summer Year 15 obtained from Representative viewpoints 1, 3, 4, 5, 7, 8 and 12, when looking in the direction included for this LVIA Chapter i.e., towards the Proposed Development. As such, there would not be significant cumulative effects upon the views from these Representative Viewpoints.

5.247 The Solar PVs of the Proposed Development within the foreground would partially screen views of the cumulative developments within the available views from Representative viewpoint 2. There would be a **Major** adverse effect at winter Year 1, which is significant, and a **Moderate** adverse effect upon Viewpoint 2; the Proposed Development is the greatest contributor due to the PVs and proposed mitigation hedgerow planting screening the other cumulative schemes within the view.

5.248 Cumulative effects upon the views obtained from Representative Viewpoint 6 would slightly increase the overall level of effects from that due to the Proposed Development in isolation during operation. However, these would not be sufficient to raise the cumulative significance of effect above the significance of effect of the Proposed Development in isolation during operation at winter Year 1 (**Moderate** adverse) and summer Year 15 (**Minor** adverse).

5.249 Views of all five cumulative schemes would be obtained at both winter Year 1 and summer Year 15 within the views from Representative viewpoints 9, 10 and 11. However, views of the cumulative schemes and the Proposed Development would be distant and in the context of existing development within Wrexham. At winter Year 1 cumulative effects upon these views would slightly increase the overall level of effect upon these views above that of the Proposed Development in isolation. However, this would not be sufficient to raise them above the effects of the Proposed Development in isolation. It is considered this would not be due to the either the Proposed Development or one of the other cumulative schemes and therefore would be equally proportioned. The cumulative schemes in-combination would introduce new built form, some permanent and some long–term but reversible, into these available views from the AONB, but the changes would be seen within the context of the existing settlements of Coedpoeth and the urban edge of Wrexham. The potential in-combination effects upon these three elevated views are not considered to be significant during the operation phase, there would be **Moderate** adverse in combination effect at Winter year 1.

5.250 By summer year 15 the establishment of planting within the Proposed Development would provide a small amount of screening to cumulative scheme Ref 4, located adjacent to the east of the Proposed Development. However, this would not be sufficient to alter cumulative effects experienced at winter Year 1 for Representative Viewpoints 9, 10 and 11 as it does for the Proposed Development. It is assumed due to available views from the AONB that mitigation planting would be provided within the cumulative schemes, but in absence of this information, the summer Year 15 level of cumulative effect would remain at **Moderate** adverse for these three views, which is a slight increase on the Proposed Development, but is not significant.

5.251 Representative Viewpoint 13 is located within the Lower Berse Farm residential cumulative scheme (Ref 4) and cumulative effects associated with this scheme in association with the Proposed Development would result in an overall level of operational cumulative effect of **Moderate** adverse, at both winter Year 1 and summer Year 15, with the main contributor to this in-combination effect being the residential cumulative scheme (Ref 4). This is an increase from the Proposed Development in isolation, which would have **Moderate** adverse effects at winter Year 1 and Minor adverse effects at summer Year 15.

5.252 Overall, it is considered that the visual resource has the capacity to absorb the cumulative schemes and the Proposed Development without any significant cumulative effects on views. This is with the exception of Viewpoints 1 and 2 at construction and winter Year 1 due to the proximity to the Proposed Development, and Viewpoint 13 during construction due to the proximity to works within Ref 4. It is not anticipated for there to be any residual significant cumulative effects once mitigation planting is in place and reached its designed intention.

Effects of Glint and Glare

Introduction

5.253 A detailed Solar Photovoltaic Glint and Glare Study has been undertaken by Pager Power (Urban and Renewables) Ltd. and is included at **Appendix 5.1** of this ES. The summary and conclusions of the study are set out below and are as taken from the Pager Power study.

5.254 Further explanation has been included within the LVIA for the Representative Viewpoints within the AONB (VP9, VP10 and VP11), referred to as ZTV Viewpoints within the Pager Power Study.

5.255 Additional obstructions which may obscure the panels from view were considered separately within the Pager Power analysis process, as was the mitigation provided within Illustrative Landscape and Ecology Masterplan (see **Figure 5.10**).

Results Summary

Roads

"The modelling has shown that solar reflections are geometrically possible towards a 1.5km section of the A483, a 3.6km section of the A525, and a 0.4km section of Heritage Way. No significant impacts are predicted on any of the modelled road sections due to the following:

- *Solar reflections are possible from panels **outside** of a road user's primary horizontal field of view (50 degrees either side of the direction of travel);*
- *There is significant screening such that views of reflecting panels are not expected to be possible in practice; and/or*
- *There is screening such that reflections will be filtered, and only marginal/fleeting views of reflecting panels are expected to be possible."* (Pager Power Glint and Glare Report 2023 – **Appendix 5.1**)

Dwellings

"The modelling has shown that solar reflections are geometrically possible towards 145 of the 251 assessed dwelling locations.

No significant impacts are predicted on the assessed dwellings due to the following:

- *Solar reflections are possible for **less** than 60 minutes on any given day and for **less** than 3 months of the year;*
- *There is significant screening such that views of reflecting panels are not expected to be possible in practice;*
- *There is screening such that reflections will be filtered, and only marginal views of reflecting panels are expected to be possible; and/or*
- *There is a significant clearance distance between dwelling observer and closest reflecting panel."* (Pager Power Glint and Glare Report 2023 – **Appendix 5.1**)

ZTV Viewpoints

5.256 The modelling has shown that solar reflections are geometrically possible towards 10 of the 13 assessed ZTV viewpoints.

5.257 Based on Pager Power's expertise, previous project experience and industry standard, ZTV viewpoints are considered to be less significant and less sensitive receptors than roads or residents within dwellings. This is in terms of both safety and amenity (road receptors are much more sensitive

in terms of safety and dwelling-based receptors are more sensitive in terms of amenity since they are static observers, and any reflection that is possible would not necessarily be fleeting).

5.258 In relation to this LVIA chapter however, our terminology differs slightly in relation to the sensitivity of users of PRoWs, as such we have further assessed the results for the potential solar reflections at VP9, VP10 and VP11 as they are within the nationally designated AONB. The additional analysis for the AONB views follows the same Pager Power methodology for the dwellings (Page 41 Pager Power Study - **Appendix 5.1**).

- **VP9 Public Right of Way (ESC/16), within the AONB** – Solar reflections are predicted from parts of the northern parcel and small part of the northern extent of the southern parcel of the Proposed Development site. Solar reflections are predicted for less than 60 minutes, between 7am and 8am, on any given day and for more than 3 months of the year split into two occurrences (early March – early May and early August to early October), there is significant screening such that views to all reflecting panels are not expected to be possible in practice and the reflecting panels are over 2.4 km away. The overall potential level of effect on visual amenity would not be different to that determined in the visual assessment, a residual effect of **Minor Adverse** significance, which is not significant in EIA terms, due to this potential for solar reflection.
- **VP10 Public Right of Way (ESC/31), within common land and the AONB** – Solar reflections are predicted from parts of the northern parcel and a small part of the northern extent of the southern parcel of the Proposed Development site. Solar reflections are predicted for less than 60 minutes, between 7am and 8am, on any given day and for less than 3 months of the year split into two occurrences (early March – early May and early August to early October), there is significant screening such that views to all reflecting panels are not expected to be possible in practice and the reflecting panels are over 2.5 km away. The overall potential level of effect on visual amenity would not be different to that determined in the visual assessment, a residual effect of **Minor Adverse** significance, which is not significant in EIA terms due to this potential for solar reflection.
- **VP11 Public Right of Way (ESC/17A), within common land and the AONB** – Solar reflections are predicted from the southern parcel of the Proposed Development site. Solar reflections are predicted for less than 60 minutes, between 7am and 8am, on any given day and for more than 3 months of the year (mid-March – mid-September), there is significant screening such that views to all reflecting panels are not expected to be possible in practice and the reflecting panels are over 3.65 km away. The overall potential level of effect on visual amenity would not be different to that determined in the visual assessment, a residual effect of **Minor Adverse** significance, which is not significant in EIA terms, due to this potential for solar reflection.

Alternative Layout

5.259 Should the layout which excludes the BESS be implemented, there would be an increase in panels within this area of the Southern Parcel. Pager Power have provided a Statement (also included within **Appendix 5.1**), which states that:

"The layout change is not significant such that remodelling is recommended. The additional panels would be screened from most directions by intervening terrain, vegetation, and/or the other solar panels within the development. There are no receptors where the predicted impact level is expected to change as a result of this layout change. This means that there would be no impact on the conclusions of the report," Pager Power Statement.

Overall Conclusions

5.260 Overall, no significant effects are predicted on surrounding road safety, residential amenity and observers located at the ZTV viewpoints in the surrounding area Mitigation is not recommended beyond that already proposed within the Illustrative Landscape and Ecology Masterplan (**Figure 5.10**).

Inter-relationships

5.261 There are inter-relationships between landscape and visual effects and other topic chapters included within this ES. These include synergies with ecology and nature conservation, arboriculture and with hydrology and flood risk that have influenced the design.

5.262 The proposed planting and varied grassland planting are designed to provide landscape integration, connectivity and visual screening within and from outside the site. The planting would have a dual function of providing visual interest and assimilation while providing wildlife corridors and continued nature conservation links with adjacent areas of ecological importance. The provision of sustainable drainage features has also been considered as part of the landscape design to provide mitigation where possible within the Proposed Development.

5.263 Further details are also provided in Chapters 6 (Ecology and Nature Conservation), and 8 (Hydrology and Flood Risk) of this ES.

Summary of Effects

5.264 The Proposed Development would introduce a large-scale solar farm within an area of agricultural fields located to the south-west of Wrexham town centre and to the north-east of the Esclusham Mountains, AONB. Areas in the south of the site were formally used for open cast mining, fall within the Plas Power Estate and contains a small area of plantation woodland. Ancient woodland lies adjacent to the west of the site and Public Right of Way (BER/1) runs north-south within the site providing public access.

5.265 The north of the site sits in the context of the urban fringe of Wrexham and the south in the context of Bersham Conservation Area that contains the historic associations that include the iron museum works and recreational associations with the Clywedog Trail running adjacent to the River Clywedog. Subtle historic references to the former Plas Power Estate remain local characterising features of this local landscape, including the estate walling, listed buildings and planted parkland trees would all remain intact. Given the solar scheme would be long-term but fully reversible and at a low level, the landscape structure can be retained and improved, and the site is well contained, there no significant effects upon the local landscape character due to the Proposed Development anticipated at construction, operation and decommission phases.

5.266 In terms of views, the site is low lying and well buffered by existing boundary vegetation with views being close ranging, from the Public Right of Way (BER/1) that runs within the site and longer distance views being obtained from elevated land to the east that includes the Clwydian Range and Dee Valley AONB. It is anticipated that a solar scheme of this scale would cause some localised obstruction to near views with Representative Viewpoints 1 and 2 that are located within the site experiencing significant visual effects during construction and at winter Year 1. By summer Year 15, mitigation planting implemented would restrict views from these two viewpoints on the PRoW, thus reducing the potential impacts to be not significant. There would be no significant effects upon the visual resource during construction, operation or decommission out with these receptors within the Proposed Development site boundary during construction only.

5.267 The full extents of the scheme would not be viewed in its entirety and, given the existing baseline context that includes field boundary hedgerows and areas of woodland within the view, this would not be considered significant. Distant views would be longer ranging and encompass a larger extent of the scheme, however given the distance the solar panels would not form an overly opponent feature in the view with long and short-distance views often being interrupted by vertical elements of pylons.

5.268 Due to the distance from the development, its low-lying nature and the containment provided by existing vegetation, it is not considered that the introduction of the Proposed Development within available views would cause a sense of urban encroachment towards the AONB (see illustrative photomontages at **Figure 5.9**). The mitigation proposed as part of the Illustrative Landscape and Ecology Masterplan (see **Figure 5.10**) would provide some further screening to the Proposed Development by summer Year 15.

5.269 Further, the Proposed Development does not lie within the designated boundaries of the AONB. A review of the key characteristics of the LCAs within the AONB, and the Special Qualities associated with the AONB, determined that although the Proposed Development would be visible within a restricted part of the AONB, the significance of potential landscape and visual effects are judged to be not significant. Potential landscape changes would be indirect and at only a slight variance to the existing character of the area. Due to the distance from the Proposed Development, and the low height of the development, the impact on the quality of available views would be Minor adverse at worst by summer Year 15. The Proposed Development would not compromise the reasons for the designation of this nationally designated landscape.

5.270 In terms of the cumulative assessment, it is considered that the visual and landscape resource of the study area has the capacity to absorb the cumulative schemes and the Proposed Development without any significant cumulative effects on landscape character during both its construction and operational phases. Additional to the two significant potential effects described above due to the Proposed Development, there would be a significant cumulative visual effect at construction phases only upon Representative Viewpoint 13 due to the proximity to works within Lower Berse Farm residential cumulative scheme (Ref 4 in **Table 5.11**).

5.271 The Proposed Development provides opportunities for enhancements to the existing field structures and ecological value of the site that would be long-term and beyond the 40-year duration of the Proposed Development.

5.272 Overall, the quality and character of the landscape and visual resources would be maintained and would have the capacity to accommodate the Proposed Development without residual significant effects. As stated in Para 1.17 LVIA Methodology (**Appendix 5.2**) a *"significant effect would not necessarily mean that the effect is unacceptable in planning terms. What is important is that the likely effects of any proposal are transparently assessed and understood in order that the determining authority can bring a balanced and well-informed judgement to bear when making any decision. This judgement should be based upon weighing up the benefits of the proposal against the anticipated effects, both positive and negative."*

Table 5.12: Summary of Likely Environmental Effects on Landscape Resource

Receptor	Sensitivity of receptor	Description of impact	Duration	Magnitude of impact	Significance of effect	Significant / Not significant
Construction						
Site Level Site	Medium	Direct impacts on the landscape of the site include minimal loss of vegetation during clearance operations for the creation of access routes, movement of onsite vehicles and the gradual implementation of solar scheme. New planting would be implemented but have little effect during this phase.	Temporary	Medium	Moderate adverse	Not significant
National Level NLCA 13: Deeside and Wrexham.	Medium	Direct impacts upon a small part of NLCA located on the eastern fringe of Wrexham that forms part of the wider context of the site. Direct impacts include movement of onsite vehicles and the gradual implementation of solar scheme.	Temporary	Negligible	Negligible adverse	Not significant
District Level **Wrexham LANDMAP** West Wrexham Ridges and Valleys 7d	Low	Direct impacts upon a small part of LCA located in and to the south of the site that forms part of the wider context of the site. Direct impacts include movement of onsite vehicles and the gradual implementation of solar scheme.	Temporary	Low	Negligible adverse	Not significant
District Level **Wrexham LANDMAP** Clywedog Valleys, Plas Power and Bersham 9a	Medium	Direct impacts upon a small part of LCA located in the southwest of the site, which forms part of the wider context of the site. Direct impacts include movement of onsite vehicles and the gradual implementation of solar scheme.	Temporary	Low	Minor adverse	Not significant
District Level **Wrexham LANDMAP** Rhosllanerchrugog Rhostyllen – Ruabon Penycae 7c	Low	Direct impacts upon a small part of LCA located in and to the south of the site, which forms part of the wider context of the site. Direct impacts would include the construction of the cable route along part of an existing road and within agricultural land.	Temporary	Low	Minor adverse	Not significant

Receptor	Sensitivity of receptor	Description of impact	Duration	Magnitude of impact	Significance of effect	Significant / Not significant
District Level **Wrexham LANDMAP** Wrexham Town 10	Low	Indirect impacts associated with additional elements of a transient nature (construction vehicles on site) would be minimal. Developed urban fringe would buffer construction impacts on this LCA	Temporary	No change	No change	Not significant
District Level **Wrexham LANDMAP** Welsh Maelor 13a	Medium	Indirect impacts associated with additional elements of a transient nature (construction vehicle on site) would be largely buffered by the residential area of Rhostyllen and the A483.	Temporary	Negligible	Negligible or Minor adverse	Not significant
District Level **Wrexham LANDMAP** Slopes to the Eastern Slopes of Ruabon Mountain 5b	Medium to High	Indirect impacts: Addition of elements of a transient nature (construction vehicles on site) would be slightly experienced from within this LCA. This introduction would not be uncharacteristic to the existing urban setting of Wrexham located to the north-east.	Temporary	Negligible	Minor adverse	Not significant
District Level **Wrexham LANDMAP** Ruabon and Esclusham Mountain 1b	Medium to High	Indirect impacts would be as above, but of a greater intensity due to a more extensive area of ZTV available within this LCA.	Temporary	Negligible	Minor adverse	Not significant
Operation and maintenance - Year 1 and Year 15						
Site Level Site	Medium	Direct impacts on the landscape of the site include: the deployment of a solar scheme on agricultural fields and landscape enhancements developing over time.	Temporary 40 years	Medium winter Year 1 Low summer Year 15	Moderate adverse winter Year 1 Minor adverse summer Year 15	Not significant
National Level NLCA 13: Deeside and Wrexham.	Medium	Direct impacts upon small part of NCA experienced within the existing context of Wrexham.	Temporary 40 years	Negligible	Negligible adverse winter Year 1 and summer Year 15	Not significant

Receptor	Sensitivity of receptor	Description of impact	Duration	Magnitude of impact	Significance of effect	Significant / Not significant
District Level **Wrexham LANDMAP** West Wrexham Ridges and Valleys 7d	Low	Direct impacts upon a small part of this LCA. Impacts associated with the introduction of the solar scheme would be greater than those during construction	Temporary 40 years	Low	Negligible or Minor adverse winter Year 1 and summer Year 15	Not significant
District Level **Wrexham LANDMAP** Clywedog Valleys, Plas Power and Bersham 9a	Medium	Direct impacts upon a small part of this LCA located in the southwest of the site. The cable route would be full reinstated at this time. Effects of the introduction of the solar scheme would be greater than those during construction	Temporary 40 years	Low	Minor adverse winter Year 1 and summer Year 15	Not significant
District Level **Wrexham LANDMAP** Rhosllannerchrugog Rhostyllen – Ruabon Penycae 7c	Low	Direct impacts associated with construction of the cable route at construction would be reinstated in this LCA at summer Year 15 but still just noticeable at winter Year 1. Indirect impacts associated with the development within the Northern and Southern Parcels would be greater than those during construction	Temporary 40 years	Negligible Year 1 No change Year 15	Negligible or Minor adverse Winter Year 1 No change summer Year 15	Not significant
District Level **Wrexham LANDMAP** Wrexham Town 10	Low	Indirect impacts associated with the adjacent solar scheme would largely be buffered by developed urban fringe	Temporary 40 years	Negligible	Negligible summer Year 1 and winter Year 15	Not significant
District Level **Wrexham LANDMAP** Welsh Maelor 13a	Medium	Indirect impacts associated with the adjacent scheme. Landscape enhancements developing over time.	Temporary 40 years	Negligible	Negligible or Minor adverse winter Year 1 and summer Year 15	Not significant
District Level **Wrexham LANDMAP** Slopes to the Eastern Slopes of Ruabon Mountain 5b	Medium to High	Indirect impacts as above.	Temporary 40 years	Negligible	Minor adverse winter Year 1 and summer Year 15	Not significant
District Level **Wrexham LANDMAP** Ruabon and Esclusham Mountain 1b	Medium to High	Indirect impacts as above	Temporary 40 years	Negligible	Minor adverse winter Year 1 and summer Year 15	Not significant

Table 5.13: Summary of Likely Environmental Effects on Visual Resource

Receptor	Sensitivity of receptor	Description of impact	Duration	Magnitude of impact	Significance of effect	Significant / Not significant
Construction						
VP1: Public Right of Way (BER/1), north	High	Close range, open view of construction within a small area of the site (north-west of the Southern Parcel). Construction would be uncharacteristic in the views obtained by this transient receptor.	Temporary	Low	Minor adverse	Significant
VP2: Public Right of Way (BER/1), south near Bersham Conservation Area	High	Impacts as described above	Temporary	High	Major adverse	Significant
VP3: Public Right of Way (BER/10) near scheduled monument	High	Close range, heavily filtered views of construction within a small area of the site (north-west of the Southern Parcel) would be uncharacteristic in the views obtained by this transient receptor.	Temporary	Low	Minor adverse	Not significant
VP4: Plas Buckley Road	Low	Close range, heavily filtered views of construction within a small area of the site (south-west of the Southern Parcel) would be uncharacteristic in the views obtained by this transient receptor.	Temporary	Low	Negligible adverse	Not significant
VP5: Tan Lian, local road	Low	Close range, heavily filtered views of construction within a small area of the site (west of the Northern Parcel) would be uncharacteristic in the views obtained by this transient receptor.	Temporary	Low	Negligible adverse	Not significant

Receptor	Sensitivity of receptor	Description of impact	Duration	Magnitude of impact	Significance of effect	Significant / Not significant
VP6: Public Right of Way (BER/11) off Penygelli Road	High	Medium range, views to construction operations being carried out within the whole site, at individual locations at a time, located within an urban fringe area comprising of fields bound by hedgerows and small areas of woodland.	Temporary	Negligible	Minor adverse	Not significant
VP7: Public Right of Way (ERD/1) within Wrexham Historic Park and Garden	High	Scoped out of the assessment				
VP8: Long Lane,	Low	Scoped out of the assessment				
VP9: Public Right of Way (ESC/16), within AONB	High	Medium range, views to construction operations being carried out within the whole site, at individual locations at a time, located within an urban fringe area comprising of fields bound by hedgerows and small areas of woodland.	Temporary	Negligible	Minor adverse	Not significant
VP10: Public Right of Way (ESC/31), within common land and AONB	High	Medium range, views to construction operations being carried out within the whole site, at individual locations at a time, located within an urban fringe area comprising of fields bound by hedgerows and small areas of woodland.	Temporary	Negligible	Minor adverse	Not significant
VP11: Public Right of Way (ESC/17A), within common land and AONB	High	Medium range, views to construction operations being carried out within the whole site, at individual locations at a time, located within an urban fringe area comprising of fields	Temporary	Negligible	Minor adverse	Not significant

Receptor	Sensitivity of receptor	Description of impact	Duration	Magnitude of impact	Significance of effect	Significant / Not significant
		bound by hedgerows and small areas of woodland.				
VP12: Public Right of Way (ESC/1)	High	Scoped out of the assessment – existing hedgerow would screen potential views of construction activities				
VP13: Public Right of Way (BER/3)	High	Close range, filtered views of construction within a small area of the site (east of Parcel A) would be uncharacteristic, but in the context of vehicle travelling on the B5098 in the views obtained by this transient receptor.	Temporary	Low	Minor adverse	Not significant
Operation and maintenance (Winter Year 1 & Summer Y15)				**Mitigation Measure**		
VP1: Public Right of Way (BER/1), north	High	Medium diastance views screened by the hedgerow to the west of the PRoW. The closing down of views at baseline would be partially offset by enhancements to the setting of the PRoW that include wildflower grassland and hedgerow improvements.	PRoW improvements including hedgerow improvements and wildflower grassland	winter Year 1 - Medium summer Year 15 - Low	Moderate adverse Minor adverse	Not Significant Not significant
VP2: Public Right of Way (BER/1), south near Bersham Conservation Area	High	Close range views channelled along the route of the green corridor that forms the route of the PRoW and would screen views of vehicles travelling on the A483 obtained at baseline. The channelling of open views at baseline would be partially offset by enhancements to the setting of the PRoW that include wildflower grassland and hedgerow improvements.	PRoW improvements including hedgerow improvements and wildflower grassland	winter Year 1 - High summer Year 15 - Medium	Major adverse Moderate adverse	Significant Not significant

Receptor	Sensitivity of receptor	Description of impact	Duration	Magnitude of impact	Significance of effect	Significant / Not significant
VP3: Public Right of Way (BER/10) near scheduled monument	High	Close range, heavily filtered views of solar panels within a small area of the site (north-west of the Southern Parcel).	Boundary reinforcement	winter Year 1 - Low summer Y15 - Low	Minor or Moderate adverse Minor adverse	Not significant Not significant
VP4: Plas Buckley Road	Low	Close range, heavily filtered views of construction within a small area of the site (south-west of the Southern Parcel).	As above	winter Year 1 - Low summer Year 15 - Low	Negligible or Minor adverse Negligible adverse	Not significant Not significant
VP5: Tan Lian, local road	Low	Close range, heavily filtered views of construction within a small area of the site (west of the Northern Parcel).	As above	winter Year 1 - Low summer Year 15 - Low	Negligible or Minor adverse Negligible adverse	Not significant Not significant
VP6: Public Right of Way (BER/11) off Penygelli Road	High	Medium range, views to large scale solar development located within an urban fringe area comprising of fields interspersed by hedgerows and small areas of woodland.	As above	winter Year 1 - Low summer Year 15 - Negligible	Moderate adverse Minor adverse	Not significant Not significant
VP7: Public Right of Way (ERD/1) within Wrexham Historic Park and Garden	High	Scoped out of the assessment				
VP8: Long Lane,	Low	Scoped out of the assessment				
VP9: Public Right of Way (ESC/16), within AONB	High	Medium range, views to large scale solar development located within an urban fringe area comprising of fields interspersed by hedgerows and small areas of woodland.	As above	winter Year 1 - Low summer Year 15 - Negligible	Moderate adverse Minor adverse	Not significant Not significant
VP10: Public Right of Way (ESC/31), within	High	Medium range, views to large scale solar development located within an urban fringe area comprising of	As above	winter Year 1 - Low summer Year 15 - Negligible	Moderate adverse Minor adverse	Not significant Not significant

Receptor	Sensitivity of receptor	Description of impact	Duration	Magnitude of impact	Significance of effect	Significant / Not significant
common land and AONB		fields interspersed by hedgerows and small areas of woodland.				
VP11: Public Right of Way (ESC/17A), within common land and AONB	High	Medium range, views to large scale solar development located within an urban fringe area comprising of fields interspersed by hedgerows and small areas of woodland.	As above	winter Year 1 - Low summer Year 15 - Negligible	Moderate adverse Minor adverse	Not significant Not significant
VP12: Public Right of Way (ESC/1)	High	Scoped out of the assessment				
VP13: Public Right of Way (BER/3)	High	Close range, heavily filtered views of solar panels within a small area of the site (east of the Southern Parcel).	As above	winter Year 1 - Low summer Year 15 - Low	Minor or Moderate adverse Minor adverse	Not significant Not significant

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Wrexham County Brough Council (WCBC) (December 2023), Wrexham Local Development Plan (LDP)

Wrexham County Borough Council (March 2007), Wrexham LANDMAP Supplementary Planning Guidance (SPG)

Clwydian Range and Dee Valley AONB Unit (2016), Clwydian Range and Dee Valley Area of Outstanding Natural Beauty Management Plan 2014 - 2019

6 BIODIVERSITY

Introduction

6.1 This chapter of the ES identifies and assess the likely significant effects on ecology and biodiversity which would result from the Proposed Development at the Plas Power Estate. It describes and addresses the existing ecology and biodiversity resources within the site and surrounding area. The chapter reports on studies (including a combination of field surveys and reports) undertaken to assess the existing resources to form a basis for the assessment of the likely significant effects of the Proposed Development, provided as Appendices to the report.

6.2 The chapter assesses the likely significant effects on ecology and biodiversity of the Proposed Development during construction, operation and decommissioning. The potential for climate change to affect the assessment is considered, as well as an assessment of the likely significant cumulative effects with other nearby developments.

6.3 Mitigation measures which have been included as part of the Proposed Development design are described. Further mitigation and monitoring which should be undertaken is described.

6.4 The principal objectives of the assessment are:

- To describe and assess the value of existing ecology and biodiversity resources within the site and surrounding area;
- To identify potential impacts of the Proposed Development on ecology and biodiversity resources and assess the significance of the effects on the identified receptors; and
- To describe further mitigation and monitoring which will be implemented as part of the Proposed Development.

Assessment Methodology

Planning Policy Context

6.5 The following national and local planning policy documents and guidance are relevant to the Proposed Development:

- Planning Policy Wales 12;
- Technical Advice 5: Nature Conservation and Planning;
- The Nature Recovery Plan for Wales 2020; and
- Future Wales – The National Plan 2040.
- Wrexham Local Development Plan 2023

Planning Policy Wales

6.6 PPW Edition 12 (Welsh Government, 2024) provides a national policy framework for Wales. Chapter 6 of PPW covers ‘Distinctive and Natural Places’. The following objectives are listed in paragraph 6.4.3 of the document, of which all are relevant:

- *'Support the conservation of biodiversity, in particular the conservation of wildlife and habitats;*
- *Ensure action in Wales contributes to meeting international responsibilities and obligations for biodiversity and habitats;*
- *Ensure statutorily and non-statutorily designated sites are properly protected and managed;*
- *Safeguard protected and priority species and existing biodiversity assets from impacts which directly affect their nature conservation interests and compromise the resilience of ecological networks and the components which underpin them, such as water and soil, including peat; and*
- *Secure enhancement of and improvements to ecosystem resilience by improving diversity, condition, extent and connectivity of ecological networks.'*

6.7 The Biodiversity and Resilience of Ecosystems Duty (Section 6 Duty) contained within the PPW states the 'Planning authorities must seek to maintain and enhance biodiversity in the exercise of their functions. This means development should not cause any significant loss of habitats or populations of species, locally or nationally and must provide a net benefit for biodiversity. In doing so planning authorities must also take account of and promote the resilience of ecosystems, in particular the following aspects: diversity between and within ecosystems; the connections between and within ecosystems; the scale of ecosystems; the condition of ecosystems including their structure and functioning; and the adaptability of ecosystems.'

Technical Advice Note 5: Nature Conservation and Planning

6.8 Technical Advice Note (TAN) 5 (Welsh Assembly Government, 2009) provides advice about how the land use planning system should contribute to protecting and enhancing biodiversity and geological conservation. The TAN provides advice for local planning authorities on:

- *the key principles of positive planning for nature conservation*
- *nature conservation and Local Development Plans*
- *nature conservation in development management procedures*
- *development affecting protected internationally and nationally designated sites and habitats*
- *development affecting protected and priority habitats and species.*

The Nature Recovery Plan for Wales 2020

6.9 The Nature Recovery Plan for Wales 2020 sets out: '*how the United Nations Environment Programme's Convention on Biological Diversity's (CBD) Strategic Plan for Biodiversity (and the associated Aichi Biodiversity Targets for 2011-20 in Wales) is addressed in Wales.'*

6.10 The 2020 plan has five main themes:

- maintaining and Enhancing Resilient Ecological Networks;
- increasing Knowledge and Knowledge Transfer;

- realising new Investment and funding;
- upskilling and capacity for delivery; and
- mainstreaming, Governance and Reporting our Progress.

Future Wales – The National Plan 2040

6.11 Future Wales – The National Plan 2040 provides: '*a strategy for addressing key national priorities through the planning system, including sustaining and developing a vibrant economy, achieving decarbonisation and climate-resilience, developing strong ecosystems and improving the health and well-being of our communities.'*

6.12 The plan addresses the key issues of health, sustainability and prosperity for Wales – in which there is an emphasis on support for renewable energy, decarbonisation, delivery of affordable housing, a commitment to metros, and creating places with a thriving Welsh language.

6.13 The plan assesses where growth should happen, what infrastructure and services are needed and how Wales can help fight climate change.

Wrexham Local Development Plan 2023

6.14 The current local plan includes the following policies relevant to biodiversity:

- Policy SP14 Natural Environment specifies that development will only be permitted where it seeks to protect, conserve and enhance the natural environment.
- Policy NE1 International and National Nature Conservation Designations specifies that development likely to significantly affect any protected site of international importance, either alone or in combination with other plans or projects, will be subject to a Habitat Regulations Assessment.
- Policy SP19 Green Infrastructure specifies that development will be required to maintain the extent, quality and connectivity of multi-functional green infrastructure on or near a site, and, where appropriate to enhance it.

6.15 Specific policies NE2 (Local Designations for Nature Conservation and Geological Importance), NE3 (Trees Woodlands and Hedgerows) and NE6 (Waste Water Treatment and River Water Quality) also relate to Biodiversity.

Relevant Guidance

6.16 The assessment follows the methods set out in guidance published by the Chartered Institute of Ecology and Environmental Management (CIEEM, 2018).

6.17 The assessment has also been prepared in relation to the following legislation and conservation priorities:

- Environment (Wales) Act 2016;
- Wildlife and Countryside Act 1981 (as amended);
- Conservation of Habitats and Species Regulations 2017 (as amended);

- Habitats / Species of Principal Importance Section 7 of the Environment (Wales) Act 2016;
- Protection of Badgers Act 1992; and
- Birds of Conservation Concern Wales 4, 2021.

6.18 The Environment (Wales) Act 2016 includes measures to provide an integrated natural resource management process to deliver the sustainable management of natural resources. That means the collective actions (including non-action) required for managing the maintenance, enhancement and use of natural resources in a way, or at a rate, which enables people and communities to provide for their social, economic and environmental well-being in Wales.

6.19 The Act requires public bodies to co-operate, share information, jointly plan for and jointly report on the management of natural resources, of which climate resilience and climate mitigation are key strands.

6.20 Section 6 of the Act sets out a biodiversity and resilience of ecosystems duty and replaces Section 40 of the Natural Environment and Rural Communities Act 2006. This applies to a range of public authorities such as the Welsh Ministers, local planning authorities and public bodies. This ensures that biodiversity is an integral part of the decisions that public authorities take in Wales. It also links biodiversity with the long-term health of ecosystems and aligns to the framework for sustainable natural resource management in the Act. The Act requires all public authorities in Wales to report on the actions they are taking to improve biodiversity and promote ecosystem resilience.

6.21 In regard to promoting the resilience of ecosystems, the Welsh Government must in particular have regard to the United Nations Environmental Programme Convention on Biological Diversity 1992.

6.22 Section 7 of the Act requires the Welsh Government to prepare and publish a list of the living organisms and types of habitat which in their opinion are of principal importance for the purpose of maintaining and enhancing biodiversity in relation to Wales, and to take measures to maintain and enhance these species and habitats. Hereafter these are referred to as' Section 7 Species' or 'Section 7 Habitats'.

6.23 The Wildlife and Countryside Act (1981) was enacted primarily to implement the Birds Directive and Bern Convention in Great Britain. The act:

- prohibits certain methods of killing or taking wild animals;
- amends the law in relation to protection of certain mammals;
- restricts the introduction of certain animals and plants;
- amends the Endangered Species (Import and Export) Act 1976;
- amends the law relating to nature conservation, the countryside and National Parks and to make provision with respect to the Countryside Commission; amd
- amends the law relating to public rights of way; and for connected purposes.

6.24 EC Directives 2009/147/EC on the Conservation of Wild Birds (the Birds Directive) and 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the Habitats Directive) are also relevant. These are implemented in the UK principally through the Wildlife and Countryside Act 1981 (as amended) and the Conservation of Habitats and Species Regulations 2017.

6.25 All wild birds, their nests and eggs are protected under Part 1, Section 1 of the Act. Birds listed in Schedule 1 of the Act are subject to special protection. Wild animals listed in Schedule 5 are protected under Section 9. Plants listed in Schedule 8 are protected under Section 13 of the Act.

6.26 The Birds Directive provides a framework for the conservation and management of, and human interactions with, all wild birds in Europe. Birds listed in Annex 1 are afforded special protection.

6.27 The provisions of the Habitats Directive are transposed into UK law by the Conservation of Habitats and Species Regulations 2017. The main aim of the Habitats Directive is to promote the maintenance of biodiversity by requiring Member States to take measures to maintain or restore natural habitats and wild species listed in the Annexes to the Directive at a favourable conservation status, introducing robust protection for those habitats and species of European importance. Member States are required to take requisite measures to establish a system of strict protection for the animal species listed in Annex IV (a) and plant species in Annex IV (b).

6.28 Where species protected by the regulations would be affected by development, a licence may be granted subject to tests set out in section 55 of the Regulations. These are that:

1) the licence must be necessary for reasons of preserving public health or public safety or other imperative reasons of overriding public interest, including those of a social or economic nature and beneficial consequences of primary importance for the environment;

2) there is no satisfactory alternative; and

3) the action authorised will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range.

6.29 The Protection of Badgers Act (1992) prohibits the deliberate killing, injuring or capturing of a wild badger; and any interfering with badger setts (and the attempt to do so). General exemptions are provided.The Act allows for licenses may be issued for the taking and killing of badgers (for example, as obtained for recent badger culls)

6.30 The Birds of Conservation Concern Wales (2021) reviews the status of all regularly occurring birds in Wales. This includes all birds that breed, winter or migrate regularly through Wales. Each species is assessed against a set of objective criteria, drawing on data collated through established bird monitoring schemes and citizen science initiatives. Each species is placed on the Green, Amber or Red List, indicating an increasing level of conservation concern. The assessment uses Wales-level data, so far as possible, to quantify historic and more recent trends in the population and range of each species, as well as its current population size, localised distribution and international importance. The UK, European and global conservation status of each species was also considered.

Study Area

6.31 The study area for terrestrial ecology extends up to 2 km from the site for non-statutory designated sites and species records, 5 km for statutory designated sites and 10km for European (international) designated sites. The study area for the baseline habitat surveys was the site and the adjoining habitat. The study area for great crested newts (GCN) included waterbodies within 500m of the site.

Baseline Methodology

6.32 The following baseline studies and surveys have been undertaken for this assessment:

- Preliminary Ecological Appraisal (**Appendix 6.1**);

- Breeding bird survey completed over three early morning transect survey visits to record the assemblage of species using the site (**Appendix 6.2**);
- Wintering bird survey completed over four early morning transect survey visits to record the assemblage of species using the site (**Appendix 6.3**);
- Great crested newt surveys comprising Habitat Suitability Index (HSI) assessment of on-site ponds, environmental DNA (eDNA) survey and populations assessment survey 2023 (**Appendix 6.4**);
- Great crested newt surveys comprising Habitat Suitability Index (HSI) assessment of on-site ponds, environmental DNA (eDNA) survey and populations assessment survey 2021 (**Appendix 6.5**);
- Otter survey to determine the suitability of habitat within and adjoining the site for otters and check for signs of otter activity (**Appendix 6.6**);
- Shadow Habitat Regulations Assessment (**Appendix 6.7**);
- Landscape and Ecology Management Plan (**Appendix 6.8**);
- Biodiversity Net Gain Assessment (**Appendix 6.9**).
- Great Crested Newt Mitigation Strategy (**Appendix 6.10**);

6.33 A Preliminary Ecological Appraisal of the site undertaken by RPS in 2020 informed the scope of further assessments undertaken along with EIA scoping undertaken in 2021 and 2023 (RPS, 2020).

6.34 Protected species surveys have been undertaken by RPS at the site between 2020 – 2023. The following surveys and reports were undertaken in 2022 – 2023 to update previous work: phase 1 habitat survey and preliminary ecological appraisal, wintering bird survey and great crested newt survey. Further details of the survey scope and timing are provided in the relevant Appendices.

Consultation

6.35 A summary of consultations with stakeholders and consultees with respect to ecology is provided in **Table 6.1** below.

Table 6.1: Consultation Responses Relevant to this Chapter

Date	Consultee and Issues Raised	How/ Where Addressed
Date	Consultee and Issues Raised	How/ Where Addressed
EIA Scoping Direction 2023		
17th October 2023	NRW welcomes that the Scoping Report states impacts on Otter and Great Crested Newt will be assessed. The Applicant's attention is drawn to NRW's comments in respect of the assessment requirements for these European Protected Species and the protected sites they are features of. NRW also advises that impacts of invasive non-native species are assessed and measures to control, to remove or for the long-term management of invasive species are specified, both during construction and operation.	This chapter assesses effects on otter and GCN. There will be limited effects on the species and their favourable conservation status will be maintained. Potential effects on GCN are also discussed in the shadow HRA (**Appendix 6.7**). Further mitigation to be implemented to protect GCN is described in this chapter with further details in the Great Crested

Date	Consultee and Issues Raised	How/ Where Addressed
		Newt Mitigation Strategy (**Appendix 6.10**). Measures to prevent the spread of and remove invasive species will be implemented as described in this chapter and the oCEMP.
NRW Meeting (Landscape & Ecology)		
8th September 2023	NRW confirmed generally the approach was acceptable but that a GCN Licence would be required and that this should detail long-term management and monitoring for both existing and new habitats, including mechanisms for ensuring delivery.	A GCN Licence will be sought for the Proposed Development.
Wrexham County Borough Council Meeting (Landscape, Trees, Drainage & Ecology)		
1st September 2023	No issues in relation to ecology were raised.	-
NRW Response to EIA Scoping 2023		
19th July 2023	**Otter and Great Crested Newt** NRW note the statement in the EIA Scoping report that the EIA will assess impacts on protected species including otter and great crested newt. NRW state that the EIA should assess direct and indirect impacts during both the construction, operation (including maintenance works) and decommissioning phases. Any necessary mitigation measures should be identified. NRW state that the EIA will need to demonstrate that the development would not be likely to be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in its natural range. The current status and favourable conservation status of the local population should also be considered.	This chapter assesses effects on otter and GCN. There will be limited effects on the species and their favourable conservation status will be maintained as described in this chapter and the shadow HRA (**Appendix 6.7**). Potential effects on GCN are also discussed in the shadow HRA (**Appendix 6.7**). Further mitigation to be implemented to protect GCN is described in this chapter with further details in the Great Crested Newt Mitigation Strategy (**Appendix 6.10**).
	Invasive Species NRW also state that measures in relation to the control/removal of invasive species should be provided.	Measures to prevent the spread of and remove invasive species will be implemented as described in this chapter and the oCEMP.
	Designated Sites NRW note that a shadow HRA will be completed for the Proposed Development and note that the EIA will need to demonstrate that the Proposed Development would not have adverse effects on the sites for which otter and great crested newts are a feature.	The shadow HRA details how adverse effects on otter and GCN will be avoided such that there will be no effect on the favourable conservation status of the qualifying features of the sites.
	River Dee and Bala Lake Special Area of Conservation (SAC) NRW note that the Proposed Development site is within the catchment of the River Dee and Bala Lake Special Area of Conservation (SAC). NRW advise that the design of both permanently sited and portable compost toilets should separate the urine and sanitary waste from the solids and that	The design of the proposed compost toilet will separate the urine and sanitary waste from the solids. There is no foul drainage requirement during the construction phase.

Date	Consultee and Issues Raised	How/ Where Addressed
	clarification is provided with respect to any foul drainage facilities that may be required during the construction phase.	
NRW Development Advice Service meeting		
13th May 2021	**GCN** NRW requested that under a precautionary approach dry ponds should be assumed to support small breeding populations of GCN in the EIA. NRW stated that mitigation for GCN should include the creation of ponds specifically for GCN, separate from any SuDS features with open water. Any SuDS can be designed to provide additional GCN habitat which would count towards the development achieving Favourable Conservation Status (FCS). Enhancement of existing lower value ponds could be proposed as part of the mitigation measures – but late succession pond habitats will have their own value and are used by different species. Nearby SAC designated for GCN is in unfavourable condition and has confirmed Chytrid amphibian disease, Crassula colonisation and fish populations. Ongoing management is continuing to bring the SAC back into favourable condition. Nearest part of SAC lies c1.7km from the site boundary. Population dispersal distance is considered to be up to 1.5km.	GCN eDNA and population surveys have been completed for ponds within 500m of the site. A GCN Mitigation Strategy has been prepared for the site. The development includes a pond designed for GCN surrounded by suitable terrestrial habitat within a Biodiversity Enhancement Area. The outline Landscape and Ecology Management Plan (LEMP) (**Appendix 6.8**) details management and monitoring measures designed to create and maintain habitat of value for GCN within the site. The HRA will assess potential impacts of the development on the GCN interest feature of the Johnstown Newt Sites SAC. This assessment considers the site in relation to the potential GCN dispersal area, and betterment of habitat for GCN in the development.
	Otter The EIA will need to consider effects on otter as a feature of the SSSI separately from the otter population as a qualifying feature of the River Dee SSSI / SAC. Historic otter survey information was collected by CCW but probably did not cover the upper section of the River Clywedog. There are a few LRC otter records confirming that the River Clywedog is within otter territory – with adults having very large ranges. NRW mentioned an otter mortality associated with a construction on SE side of Wrexham adjoining small watercourse partly culverted (River Gwenffro) The cable route will cross the river in one location; either at an existing vehicle bridge or as HDD beneath the river. Both options would avoid impacts on the watercourse and woodland. NRW confirmed that if HDD was required there should be no impact on otters. It was agreed that adopting impact avoidance measures should ensure no effect on the FCS of otter in the river or wider River Dee SAC.	An otter survey was undertaken to assess the use of the River Clywedog and by otters and the suitability of adjoining woodland. The development has been designed to avoid potential impacts on otter through: • Stand-offs from woodland and river • Siting of cable route away from otter resting places and higher quality otter habitat The HRA will assess potential impacts of the development on the otter interest feature of the River Dee and Lake Bala SAC.

Date	Consultee and Issues Raised	How/ Where Addressed
	Bats NRW stated that potential impacts on bats need to fully considered. It was confirmed that there will be no permanent lighting associated with the development but there may be occasional use of task specific lighting during maintenance operations. NRW stated that where the development can demonstrate that there is no potential for impacts; surveys would not be a requirement.	The development has been designed to avoid potential impacts on bats through: • Stand-offs from woodland • Retention of and stand-offs from mature trees • Retention of and stand-offs from hedgerows • No permanent lighting.
	Other species There is only one record of dormouse in the wider locality – in a location on the border with Cheshire where there was a dormouse re-introduction project. There have been no recent records. NRW agreed that dormouse did not need to be considered in the EIA. RPS confirmed that the precautionary approach being taken is assuming the presence of reptiles and hedgehogs where the habitats are suitable. NRW stated that where the development can demonstrate that impacts are being avoided; surveys would not be a requirement.	The development has been designed to avoid potential impacts on protected species through the retention and protection of higher value habitat including: • Woodland • Mature trees • Hedgerows • Ponds The CEMP will include species protection measures to be adopted during enabling works and construction.
	Invasive species NRW emphasised the importance of good biosecurity at this site, especially during preliminary investigations and construction with more teams working on the site with the potential for diseases such as Phytopthora to brought onto site. NRW also highlighted the presence of the invasive non-native plant Himalayan balsam in locality.	Biosecurity measures were followed during pond surveys to avoid the spread of disease. The CEMP will include biosecurity measures to be adopted during enabling works and construction. The development has been designed to avoid spread of non-native plant species Himalayan balsam through stand-offs and eradication measures.
EIA Scoping Direction 2020		
2nd December 2020	**Designated Sites** Further information requested	Further information on designated sites is provided and likely significant effects assessed in this chapter
	Invertebrates Further information requested	Further information on the value of the site for invertebrates is provided and likely significant effects assessed in this chapter
	Bats, Dormouse, Hedgehog and Reptiles Advised that potential impacts on these species are not scoped out	Likely significant effects on these species are assessed in this chapter
	Cumulative Impacts	This has been taken into consideration in this chapter

Date	Consultee and Issues Raised	How/ Where Addressed
	Sensitive receptors to cumulative impacts should include birds, invertebrates, bats, dormouse, reptiles and hedgehogs in addition to otter and GCN.	
	Mitigation and Enhancement It is advised that a Biodiversity Management Plan is provided to include mitigation, enhancement measures, biodiversity aims, management during operation, monitoring measures and criteria for changes to management practices.	These are provided in the oLEMP (**Appendix 6.8**).
NRW Response to EIA Scoping 2020		
17th June 2020	**Otter and GCN** NRW note that the Proposed Development has the potential to have environmental effects on otter and GCN which are European Protected Species and features of nearby designations and have been recorded close to the site. NRW request further consideration of potential impacts during construction, operation and de-commissioning and the measures envisaged to avoid or prevent significant effects.	As previously noted, this chapter assesses effects on otter and GCN. There will be limited effects on the species and their favourable conservation status will be maintained. Further mitigation to be implemented to protect GCN is described in this chapter with further details in the Great Crested Newt Mitigation Strategy (**Appendix 6.10**).
	Habitat Loss NRW state that the development could result in environmental effects due to habitat loss and disturbance from the Proposed Development.	Habitat creation and retention will result in an overall biodiversity gain, details of the landscaping design are provided in this chapter and the LEMP (**Appendix 6.8**).
	Cumulative Impacts NRW indicate that cumulative effects with nearby developments should be considered.	This has been taken into consideration in this chapter
NRW Response to Statutory Pre-Application Consultation		
4th April 2024	**Great Crested Newts (GCN)** NRW consider that the size of the GCN population may have been underestimated due to the lack of consideration of: (a) the subterranean behaviour of the species (b) dispersal distances can be up to 500m (c) weather conditions during the springs of 2021 and 2023 NRW also consider the timings of the 2021 and 2023 GCN surveys (Appendix 6.4 and 6.5, ES Volume 3), undertaken late in the survey season, may mean the size of the GCN population has been underestimated. NRW does not concur with the potential sensitivity conclusion of the GCN population as low.	The assessment has been updated with additional information on the potential for GCN to use terrestrial habitat within the site. Additional measures have been included within the mitigation strategy to protect GCN. GCN surveys were undertaken according to the standard CIEEM methodology and guidance. Additional consideration of weather conditions and timings has been provided.
	GCN Mitigation Strategy NRW does not agree that core habitat and Cresswell and Whitworth (2004) is necessarily transferable in higher pond density landscapes and sites with larger populations. NRW agrees that there is a lower risk of GCN being present in shorter grazed land, but that GCN are found in shorter grazed grassland. NRW advises the use of amphibian fencing and carpet tiles within 250m of ponds where GCN have been recorded during clearance works.	GCN Mitigation Strategy (**Appendix 6.10**) – updated to include additional information requested. The layout of the development and topography limits the available land for pond creation at the south of the Site. As such an area at the north of the Site has been designated as a Biodiversity Area where three ponds will be created and the surrounding land managed to

Date	Consultee and Issues Raised	How/ Where Addressed
	NRW requests detail of where GCN are proposed to be relocated to. NRW advise a biosecurity risk assessment is completed and subsequent method statement prepared. NRW would welcome the construction of one or more ponds in the environs of the southern boundary as stepping-stones to the GCN populations located in the environs of Johnstown.	provide terrestrial habitat with value for GCN.
	Outline LEMP NRW request that a monitoring target should be defined for GCN. NRW request GCN monitoring biennially (or annually in the event of fish/invasive non-native species are detected) through Habitat Suitability Index (HSI) to be reported through the Wales GCN Monitoring scheme. NRW confirm an Ecological Compliance Audit for all defined ecological features as part of construction phase monitoring. NRW advises further detail to be included in the full LEMP prior to construction commencing.	oLEMP (**Appendix 6.8**) – updated to incorporate NRW comments. A specific monitoring target is not defined for P3 on the basis that it is located outside of the red line boundary and the applicant will have limited ability to control the management of the pond to ensure that the target is met.

Assessment Criteria and Assignment of Significance

6.36 The assessment of ecological effects from the Proposed Development focusses on 'important ecological features' (IEFs). These are species and habitats that are valued in some way and could be affected by the Proposed Development. Other IEFs may occur on or in the vicinity of a Proposed Development but do not need to be considered because there is no potential for them to be significantly affected.

Receptor Sensitivity / Value

6.37 Each IEF is ascribed a sensitivity / value based on several parameters as set out in **Table 6.2.**

Table 6.2: Definitions of Sensitivity / Value of Ecological Receptor

Sensitivity / Value	Typical Descriptors
Very High	Very high importance and rarity, international scale and very limited potential for substitution. This includes: • Sites of international (i.e. greater than UK or Welsh) significance e.g. Special Areas of Conservation (SAC), Special Protection Areas (SPA), Ramsar Sites. • Sites which have features sufficiently unique or unusual as to be considered one of the highest quality examples in an international or national context and therefore are likely to qualify as a site of European or international importance. • Resident, or regularly occurring, populations of species which may be considered at an International or European level where: o the loss of these populations would adversely affect the conservation status or distribution of the species at this geographic scale; or o the population forms a critical part of a wider population at this scale; or o the species is at a critical phase of its life cycle at this scale.
High	High importance and rarity, national scale, and limited potential for substitution. Sites of UK or National (Welsh) Importance e.g. Sites of Special Scientific Interest (SSSI) & National Nature Reserves (NNR). This includes:

Sensitivity / Value	Typical Descriptors

	• Sites which have features sufficiently unique or unusual as to be considered one of the highest quality examples nationally and therefore are likely to qualify as a site of national importance.
	• Resident, or regularly occurring, populations of species which may be considered at an International, European, UK or National level where:
	  ○ the loss of these populations would adversely affect the conservation status or distribution of the species at this scale; or
	  ○ the population forms a critical part of a wider population at this scale; or
	  ○ the species is at a critical phase of its life cycle at this scale.

Medium	High or medium importance and rarity, regional scale, limited potential for substitution.
	This includes:
	• Sites of Regional (Northern Wales) or County Importance e.g. Sites of Nature Conservation Importance (SINCs), Local Nature Reserves (LNRs) Local Wildlife Sites (LWSs) and Ancient Woodland.
	• Priority habitats in UK Biodiversity Action Plan (BAP), Habitats of Principal Importance under the Section 7 of the Environment (Wales) Act (2016) and Ancient Woodland.
	• Sites which have features sufficiently unique or unusual as to be considered one of the highest quality examples in the regional / county context and therefore are likely to qualify as a site of regional / county importance.
	• Resident, or regularly occurring, populations of species which may be considered at an International, European, UK or National level and key/priority species listed within Local BAPs (LBAP) where:
	  ○ the loss of these populations would adversely affect the conservation status or distribution of the species at this scale; or
	  ○ the population forms a critical part of a wider population at this scale; or
	  ○ the species is at a critical phase of its life cycle at this scale.

Low	Low or medium importance and rarity, local scale. This includes: • Sites of District / Local Importance but unlikely to be of sufficient value to merit a formal nature conservation designation. • Presence of LBAP habitats or species, where the action plan states that all areas of representative habitat or individuals of the species should be protected. • Areas of habitat; or populations / communities of species considered to appreciably enrich the habitat resource within the local context (such as veteran trees), including features of value for migration, dispersal or genetic exchange.
Negligible	Very low importance and rarity, local scale. Includes features of site level value and of no more than Parish importance.

6.38 In assigning a sensitivity / value to a site, habitat or species population or assemblage, its distribution and status (including a consideration of trends based on available historical records) are considered. Rarity is considered because of its relationship with threat and vulnerability, and the need to conserve representative areas of habitats and genetic diversity of species populations, although rarity in itself is not necessarily an indicator of sensitivity / value. A species that is rare and declining is assigned a higher sensitivity / value than one that is rare but known to be stable.

Magnitude of Impact

6.39 The magnitude of impacts has been determined based on the parameters set out in **Table 6.3.**

Table 6.3: Definitions of Magnitude

Sensitivity	Typical Descriptors
High	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements (Adverse).
	Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality (Beneficial).
Medium	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements (Adverse).
	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality (Beneficial).
Low	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements (Adverse).
	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring (Beneficial).
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features or elements (Adverse).
	Very minor benefit to or positive addition of one or more characteristics, features or elements (Beneficial).
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.

6.40 Both sensitivity/value and magnitude have been taken into account in determining the significance of effect. This assessment also defines significance based on the following:

- Reference to regulations or standards;
- Reference to best practice guidance;
- Reference to policy objectives;
- Reference to criteria, for example designations or protection status;
- Outcomes of consultation to date; and
- Professional judgement based on local / regional / specialist experience.

6.41 Conservation status is described by the CIEEM (2018) guidance as follows:

'Habitats – conservation status is determined by the sum of the influences acting on the habitat that may affect its extent, structure and functions as well as its distribution and its typical species within a given geographical area.'

'Species – conservation status is determined by the sum of influences acting on the species concerned that may affect its abundance and distribution within a given geographical area.'

6.42 The assessment of whether the favourable conservation status of an IEF is likely to be compromised has been made using professional judgement based on an analysis of the predicted impact with reference to specific parameters outlined in **Table 6.2** and **Table 6.3**.

6.43 In assessing the magnitude of impacts, consideration has been given to the fragility or stability of the habitats and the sensitivity of the species potentially affected by the Proposed Development.

Fragile habitats are those which are readily damaged by human activity. Fragility and stability can be expressed in terms of the degree of change in species abundance and composition following disturbance. Sensitive species are those that are highly susceptible to disturbance, for example as a direct disturbance as result of human activity, noise etc., or the loss of key habitats used by a species that are not present in the surrounding area.

Significance of Effects

6.44 The assessment of significance is based on the assessment matrix shown in **Table 6.4**.

Table 6.4: Assessment Matrix

Sensitivity	Magnitude of Impact				
	No Change	Negligible	Low	Medium	High
Negligible	No change	Negligible	Negligible or Minor	Negligible or Minor	Minor
Low	No change	Negligible or Minor	Negligible or Minor	Minor	Minor or Moderate
Medium	No change	Negligible or Minor	Minor	Moderate	Moderate or Major
High	No change	Minor	Minor or Moderate	Moderate or Major	Major or Substantial
Very high	No change	Minor	Moderate or Major	Major or Substantial	Substantial

6.45 The nature of the effects has been classified as adverse, beneficial or no change. Where the matrix offers more than one significance option, professional judgement has been used based on all the available information to decide the most appropriate level of significance.

6.46 The assessment states the geographic context of the significance of effects and whether adverse or positive (site, local, district, etc). The assessment also references the EIA Regulations and whether effects are significant (moderate or higher) or not significant (minor, negligible and no change).

6.47 The broad definitions of the terms used are in line with the following:

- Substantial: Only adverse effects are normally assigned this level of significance. They represent key factors in the decision-making process. These effects are generally, but not exclusively, associated with sites or features of international, national or regional importance that are likely to suffer a most damaging impact and loss of resource integrity. However, a major change in a site or feature of local importance may also enter this category.

- Major: These beneficial or adverse effects are considered to be very important considerations and are likely to be material in the decision-making process.

- Moderate: These beneficial or adverse effects may be important, but are not likely to be key decision-making factors. The cumulative effects of such factors may influence decision-making if they lead to an increase in the overall adverse effect on a particular resource or receptor.

- Minor: These beneficial or adverse effects may be raised as local factors. They are unlikely to be critical in the decision-making process, but are important in enhancing the subsequent design of the Proposed Development.

- Negligible: No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

Limitations of the Assessment

6.48 There were no significant limitations to surveys affecting the robustness of the assessment. Any minor limitations to surveys were recorded and are listed in the relevant survey reports presented as appendices to this chapter.

Baseline Environment

Designated Sites

6.49 There are three SACs and one Ramsar site within 10km of the site (as described further in **Appendix 6.1**). The closest of these is Johnstown Newt Sites, located 1.69km from the site. These sites have importance for nature conservation at an international scale (very high value).

Johnstown Newt Sites SAC

6.50 Johnstown Newt Sites SAC is located 1.69km from the Proposed Development at its closest point.

6.51 The designation supports one of the largest known populations of GCN in Great Britain and has been the focus of much conservation management. It comprises two post-industrial sites where coal and clay have been extracted.

Berwyn and South Clwyd Mountains SAC

6.52 Berwyn and South Clwyd Mountains SAC is located 2.36km from the Proposed Development.

6.53 The designation comprises European dry heath and blanket bog habitat. Berwyn contains the largest stands of upland European dry heath in Wales and the most extensive tract of near-natural blanket bog in Wales.

Midlands Meres & Mosses Phase 2 Ramsar

6.54 Midlands Meres & Mosses Phase 2 Ramsar is located 5.87km from the Proposed Development.

6.55 The designation comprises a diverse range of habitats from open water to raised bog and supports a number of rare species of plants associated with wetland habitat. The site additionally supports an assemblage of invertebrates including several rare species.

River Dee and Bala Lake SAC

6.56 The River Dee SAC is located 7.11km from the site. The River Clywedog to the south of the site flows into the SAC.

6.57 The primary reasons for the SAC designation are its classification as a 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation' and its

populations of Atlantic salmon and floating water-plantain. Other qualifying features are its populations of otter, sea lamprey, brook lamprey, river lamprey and bullhead.

Sites of Special Scientific Interest

6.58 Three SSSIs lie within 2km of the Proposed Development, the closest being Gatewen Marsh located 1.16km from the site (as described further in **Appendix 6.1**). These sites have importance for nature conservation at the national scale (very high value).

Local Designations for Ecology

6.59 There are 17 non-statutory sites located within the 2km search radius of the site, all of which are designated as Wildlife Sites (WS). Two of these adjoin the site boundary: Higher Berse Marsh WS and Big Wood WS.

6.60 Big Wood WS (and Ancient Woodland) is a mixture of conifer plantation, beech plantation and patches of semi-natural broadleaved woodland along the River Clywedog. Many conifer trees have been felled as part of the management regime. The broadleaved canopy is dominated by sycamore and beech. The section adjoining the survey area is open, lacking a dense understorey and is frequented by dog walkers.

6.61 Higher Berse Marsh WS comprises two areas of marshy grassland separated by Higher Berse road. The southern section adjoins the Proposed Development and includes an area of wet woodland with a pond at the centre.

6.62 There are a further three WSs within 500m of the Proposed Development. Nant Mill Bat Sites WS is located 170m south of the Proposed Development. The WS is a large building supporting bat roosts.

6.63 Nant Mill Grassland WS is located 200m south of the Proposed Development and comprises a section of grassland located between Big Wood and Mill Terrace Road

6.64 The Afon Gwenfro WS located beyond the B5430, 430m north of the site. The WS is a reclaimed coal site with semi-improved neutral grassland, scrub, broadleaved woodland and a small wetland.

6.65 WSs over 500m from the Proposed Development include areas of woodland, parkland, marshy and neutral grasslands, post-industrial and mosaic habitats.

6.66 All the non-statutory designated sites have county importance for biodiversity.

6.67 The full desk study information is presented in the Preliminary Ecological Appraisal (PEA) (**Appendix 6.1**).

Habitats

6.68 The habitats within the site are summarised below with more detailed descriptions provided in the PEA (**Appendix 6.1**). The habitats are illustrated on **Figure 6.1**.

Arable Fields

6.69 There are seven arable fields at the north of the site, used as grass ley and for crop production.

6.70 The arable habitat has ecological importance only at the level of the site which is located within an arable landscape (negligible value).

Improved Grassland

6.71 The majority of the site comprises close-grazed pasture fields that classify as improved grassland.

6.72 The fields are dominated by perennial rye-grass (over 50%), with other grasses and forbs rarely present including creeping bent, annual meadow-grass, Yorkshire fog, spear thistle, white clover and creeping buttercup. In shaded field margins, Yorkshire fog was occasionally locally abundant.

6.73 Improved grassland is common in the surrounding area and has ecological importance only at the level of the site (negligible value).

Poor Semi-improved Grassland

6.74 Two small areas of semi-improved grassland are present in the northern section of the site. The grassland is characterised by Yorkshire fog, creeping bent, cock's-foot, hogweed and common nettle.

6.75 Strips of rank grassland and tall ruderal vegetation were also present along trackways within the central area.

6.76 The semi-improved grassland has a low species diversity. It is not uncommon in the surrounding landscape and is characteristic of agriculturally modified habitats. The grassland has ecological value in the context of the site (negligible value).

Hedgerows

6.77 At the north of the site, tall, wide hedgerows with trees border the arable fields, some of which are species-rich. The improved fields are bounded by species-poor hedgerows and fence lines. The species-poor hedgerows are a mix of dense structured wide field boundaries and defunct hedges with multiple gaps.

6.78 The hedgerows are part of the network of connected habitats and help to link small blocks of woodland in the wider area.

6.79 Mature / semi-mature pedunculate oak, sycamore and ash trees are present within hedgerows at the north of the site.

6.80 The trees provide habitats for range of fauna and are typically associated with an assemblage of invertebrates. The mature tree resource currently has ecological importance at least in the context of the site.

6.81 Man-made drainage ditches with vertical banksides and narrow channels are present along several of the hedgerows. Only one of these held shallow water during survey walkovers. The ditch channels are associated features of hedgerows and contribute to the value of the hedgerow network.

6.82 Each of the individual hedgerows is a Habitat of Principal Importance (HPI) under Section 7 of the Environment (Wales) Act 2016 and are a key ecological resource within the site. The hedgerow field boundaries within and bounding the site are of ecological importance in a local context (medium value).

Field Drain

6.83 A field drain adjoining the A525 bounds the arable northern section of the site. The drain had a shallow water depth and supports common tall ruderal species. The drain has importance in a local context (low value).

Off-site Habitats

Broad-leaved Woodland

6.84 Big Wood, a semi-natural broadleaved woodland designated as a WS, adjoins the site to the south. The section of the broadleaved woodland adjoining the site supports mature and semimature trees, primarily sycamore, ash, oak and alder. The woodland has an open structure, with a high canopy, sparse patches of scrub and ground flora including patches of ivy and bluebell. The River Clywedog and a tributary stream flow through the woodland close to the site boundary.

6.85 Further woodland blocks comprising semi-natural broadleaved and mixed plantation woodland adjoin arable fields within the site to the east. These woodlands are all younger than Big Wood but have a distinct canopy with sparse shrubs and woodland ground flora beneath. The mixed plantation woodland comprises similar species to the adjoining semi-natural woodland, additionally including pine *Pinus* sp. and larch *Larix* sp..

6.86 A central area of mixed plantation woodland is bounded on all sides by fields within the site. It is dominated by young silver birch and ash with hawthorn, alder and pine also present. The trees are planted at high density with patches of bramble and grasses present in less shaded sections.

6.87 Parts of the off-site woodland will classify as Lowland mixed deciduous woodland HPI and are a key ecological resource which have value within the context of at least the local area (low value).

Watercourses

6.88 The River Clywedog flows south-east through Big Wood and beneath Mill Terrace road to the east of the southern area. The section of river adjoining the site is 5m wide with shallow fast-flowing water and a stony riverbed.

6.89 The river is a Habitat of Principal Importance (HPI) and has value in the context of at least the local area (up to medium value).

6.90 A shallow stream flows westwards between a narrow unclassified road and pasture fields alongside part of the preferred cable route option. The stream is 1m wide along this section. Mature trees, hedgerows and a narrow fringe of tall ruderal are present on the banksides.

6.91 The stream has value in the context of the local area (low value).

Waterbodies

6.92 Several ponds are located in the surrounding area, including ponds P1 – 3 which are located adjacent to the site boundary.

6.93 P1 lies within Higher Berse Marsh WS 70m to the east of the site. The pond measures approximately 40m by 10m and has formed in a low-lying area of the marsh, with shallow gently sloping banks. Willow trees and mixed species scrub surround the pond.

6.94 P2 is a rectangular man-made waterbody located within the central block of mixed plantation woodland bounded on three sides by fields within the site. The large waterbody is 150m by 50m and has a margin of common reed and bulrush.

6.95 P3 is located within broadleaved semi-natural woodland 60m west of the site. The pond measures 50m by 25m and has little emergent vegetation, showing signs of eutrophication with dense duckweed *Lemna* sp. covering much of the surface.

6.96 The ponds are considered to have value in the context of the local area (low value).

Faunal Species

6.97 The use of the site by protected species and its value for these species are described briefly below. Full details of the Phase 2 surveys undertaken are provided in the survey reports (**Appendices 6.1 – 6.6**).

Bats – Roosts

6.98 Mature and semi-mature sycamore, oak and ash trees are distributed within hedgerows and boundary woodland throughout the site and, rarely, as stand-alone trees within the fields (as described further in **Appendix 6.1**). These trees are of a sufficient age and size to contain potential roost features which may support bats.

6.99 There is potential for bats to be roosting in mature and semi-mature trees within the site or in woodland or buildings adjacent to the site.

6.100 Transitional roosts of common species are widespread and used by a small number of bats. If present, these would be of importance at a site or local context (low value). A Higher value roost such as a maternity colony and/or uncommon species would have value in a district or county context (medium value).

Bats – Activity

6.101 The hedgerows trees, ponds and open water ditches are expected to be associated with flight lines and foraging activity (as described further in **Appendix 6.1**). Lower levels of bat activity are typically associated with the central parts of arable fields and improved grassland away from field boundaries.

6.102 The low floristic diversity in the semi-improved grassland would be expected to limit the abundance of invertebrate prey and level of bat activity.

6.103 The boundaries adjoining broadleaved woodland, ponds will have the potential to be regularly utilised by bat species.

6.104 In the immediate surroundings the River Clywedog and its tributary stream are also expected to be important flight corridors and foraging areas for bats and it is assumed they will be used by a range of bat species. Outside the site boundary, Big Wood, River Clywedog and other blocks of broadleaved woodland have higher potential value and their connectivity with the site increases the potential levels of bat activity within the site, primarily along field boundaries.

6.105 Overall, the habitats within the site and surrounds are expected to have importance for foraging bat species in the context of the local area (low value).

Water Voles

6.106 The field ditches associated with hedgerows within the site have low to negligible potential to support water vole due to their shallow water depth and limited aquatic vegetation (as described in **Appendix 6.1**). Therefore, onsite habitat is considered to have potential value for water vole in at most in the context of the site.

Otter

6.107 Otters are active along the section of the River Clywedog flowing through Big Wood to the south of the site. The otter survey undertaken of the river and adjoining habitat in August 2021 is described further in **Appendix 6.6**. A feeding station and possible daytime resting place were recorded to the south of an unclassified road (Mill Terrace). Other otter signs have been recorded along the river including a potential holt located 450m from the site boundary.

6.108 In contrast the habitats within the site have negligible importance for otter (negligible value) with no evidence of otter activity within the site or in wooded habitats adjacent to the site boundary which were specifically searched for signs of otter activity. Based on the structure of the woodland habitat it was concluded that there was very low potential for otters to lay up during the day in woodland between the river and the site.

6.109 Otters will be active along the river corridor during night time hours and potentially resting up during the day. Sections of dense vegetation are present close to the main river in some sections, but there is very limited cover for otter in the wider beech woodland between the river and the site boundary.

6.110 The off-site wooded river corridor has value for otter in at least a district context (medium value).

Badgers

6.111 Although the fields within the site provide potential foraging resource for badgers, there is no evidence of any active setts within the site and very few signs of badger activity have been recorded in the wider area during the walkover surveys in 2023 (as described in **Appendix 6.1**).

6.112 Badger is a common and widespread species of low conservation importance. Based on the general lack of signs, badgers are considered to use the site infrequently and the onsite habitat is considered to have potential value for badger in the context of the site (negligible value).

Dormouse

6.113 The intact, dense and scrubby hedgerows provide suitable cover for dormouse and food sources and have good connectivity to offsite woodland (as described in **Appendix 6.1**).

6.114 The treelines and defunct hedgerows within the site have poor connectivity and provide less extensive areas of habitat and are considered sub-optimal for dormouse. The sparse understorey in the area of Big Wood immediately adjoining the site limits the potential value of the habitat for dormouse.

6.115 The hedgerows within the Proposed Development and adjoining woodlands have the potential to support a dormouse population. If present, it is anticipated that a dormouse population would have county importance (medium value).

Hedgehog

6.116 The hedgerows and hedge base flora provide suitable habitat and dispersal routes for hedgehog (as described in **Appendix 6.1**).

6.117 These habitats are considered to have importance for hedgehog in the context of the site (negligible value).

Breeding Birds

6.118 A breeding bird assemblage of 48 species was recorded within the site and adjoining habitat in spring – summer 2021 (as described further in **Appendix 6.2**). A total of 20 of the recorded species qualify as being of 'conservation interest'. Five species listed on the Birds of Conservation concern (BoCC) Red list for Wales were classified as confirmed, probable or possible breeding species within the survey area: kestrel (one pair possible), whitethroat (up to three pairs), goldcrest (four pairs possible), meadow pipit (one pair probable) and willow warbler (up to two pairs). Kestrel is also classified as Species of Principal Importance (SPI) under Section 7 of the Environment (Wales) Act 2016.

6.119 Five red list species were recorded within the survey area but did not show signs of breeding: herring gull, lesser black-backed gull, linnet, swift and starling.

6.120 Five species listed on the BoCC Amber list for Wales were classified as confirmed, probable or possible breeding species within the survey area: grey wagtail (one pair possible), house sparrow (one pair probable), mistle thrush (one pair probable), skylark (two pairs probable) and dunnock (three pairs). Three of these BoCC species are also classified as SPI.

6.121 Two amber list species were recorded within the site but did not show signs of breeding: bullfinch and house martin.

6.122 Song thrush (three pairs probable) has recently been reclassified as a Green List species in Wales.

6.123 The majority of the breeding species recorded during the survey were using the off-site woodlands adjoining the boundary of the site. Four species of conservation concern/importance were recorded as confirmed or probably breeding within the site: willow warbler, skylark, dunnock and meadow pipit. All were present in small numbers and none are locally uncommon or scarce. The hedgerows within the site will be part of the foraging areas for these species and will provide resources that contribute to breeding success. Ground nesting birds (skylark and meadow pipit) were recorded nesting in the fields.

6.124 The arable landscape will also be used as a foraging resource by farmland species.

6.125 Overall, the breeding bird assemblage within the site and adjoining habitat is classified as having local level importance (low value).

Wintering Birds

6.126 A total of 46 species were recorded within or adjacent to the onsite habitats during the wintering bird surveys in winter 2022 / 2023 (as described further in **Appendix 6.3**). Of the recorded species, 24 species meet at least one of a range of criterion relating to nature conservation.

6.127 Black-headed gull, rook, meadow pipit and common gull were recorded using the site in high numbers. The site has up to county level importance (medium value) for black-headed gull, rook and meadow pipit and local importance (up to medium value) for common gull.

6.128 The site has site-level importance (low value) for the following species of conservation concern in Wales: coal tit, fieldfare, great black-backed gull, grey heron, herring gull, kestrel, lapwing, lesser black-backed gull, redwing, starling and snipe. The following species were recorded in low numbers along the site boundaries: bullfinch, chaffinch, dunnock, goldcrest, goshawk, linnet, mistle thrush, skylark and song thrush.

Great Crested Newts

6.129 Great crested newt survey reports for surveys undertaken in spring 2021 and spring 2023 are provided in Appendices 6.4 and 6.5 respectively.

6.130 Waterbody P3 located within the wider Plas Power Estate supports a small breeding population of GCN confirmed through surveys completed in spring 2021. The likely absence of GCN has been confirmed at five other ponds/waterbodies located in close proximity to the site (WB1, P1, P2, P4 and P10). P5, 60m north of the site was dry in both 2021 and 2023 and under a precautionary approach a small population of GCN is assumed at the pond. Ditches within and adjoining the site are unsuitable for GCN.

6.131 Medium sized GCN populations were additionally recorded at waterbodies WB8 and WB9 located over 580m southwest of the site.

6.132 The locations of each pond are defined on the results plan in **Appendix 6.5.**

6.133 GCN will be present in terrestrial habitats in the vicinity of P3 with the majority of individuals within a GCN population typically remaining in suitable habitats (scrub/rank grassland) within 50m of a breeding pond throughout the year. Smaller numbers of GCN will use habitats in the wider area, with dispersal distances considered to typically be within 500m from the breeding pond. P3 is located within a large area of woodland located approximately 60m from the site at the closest point.

6.134 Woodland, scrub and areas of taller grassland around P3 will have high importance for the GCN population. The habitat provides dense vegetation cover and will support invertebrates on which GCN will prey. All woodland, scrub and taller grassland surrounding P3 which provide higher value terrestrial habitat is located outside of the Site boundary. siteThe hedgerow network (and off-site woodland) and taller grassland around field margins form wildlife corridors along which species including newts can move through the landscape. The ditches across the wider site also have the potential to be used as foraging habitat by GCN. The taller grassland and off-site woodland also have the potential to be foraging habitat. These habitats are all located over 250m from ponds where GCN have been recorded.

6.135 Habitat within the Site within 250m of P3 is limited to short-grazed grassland. The grassland lacks cover and has lower value for GCN.

6.136 GCN could be present in suitable habitats in the vicinity of the pond P5. The pond is located within a block of woodland surrounded by arable. The A525 and a narrow strip of plantation woodland lie between the pond and northern edge of the site. The road and arable habitat are significant barriers to GCN between P5 and the site, though some movement of individuals between the pond and site is possible.

6.137 The core habitat of the populations within P8 and P9 do not fall within the site and the on-site habitats would not be expected to have value for individuals within these breeding populations.

6.138 In the wider area, Johnstown Newt Sites SAC is designated for its population of GCN, which is one of the largest known in Great Britain and has been the focus of much conservation management. The SAC covers multiple sites in the wider area with the closest being 1.69km to the south of the

site. Given the distance between the site and the SAC and the lack of direct connectivity movement of individuals between the two areas is expected to occur very rarely at most.

6.139 Habitats within the site has importance for GCN in a local context (low value).

Reptiles

6.140 The majority of the site has very low value for reptiles, lacking cover and invertebrate prey species (as described in **Appendix 6.1**). Taller vegetation alongside hedgerows and ditches provide areas of cover and potential foraging habitat.

6.141 The habitats with suitability for reptiles are widespread in the surrounding landscape. Slow worm and grass snake have been recorded in the local area in the past and there is potential for populations of both species to occur in habitats within or adjoining the site.

6.142 Overall the site is considered to have importance for reptiles at no more than the level of the site (negligible value).

Invertebrates

6.143 The intensively managed arable will have very limited value for invertebrates and the standard use of chemicals as part of agricultural farming practice over the long term will have adversely affected the invertebrate populations at the site (as described in **Appendix 6.1**).

6.144 The low botanical diversity of the grasslands within the site also limits their potential value for invertebrates.

6.145 The mature trees, hedgerows and ditches are the principal habitats of value for invertebrates within the site. The species assemblage at the site will also benefit from the presence of adjoining off-site aquatic and wooded habitats.

6.146 Overall, the site is considered to have ecological importance for invertebrates in the context of the site only (negligible value).

Future Baseline Conditions

6.147 The UK Climate Change Risk Assessment for Wales (HM Government, 2012) identified the main potential risks to the natural environment as a result of climate change. Those risks relevant to the site are:

- reduction in soil moisture and lower river flows, and an increase in the frequency and magnitude of droughts;
- low water levels and reduced river flows leading to increased concentration of pollutants from agriculture, sewage and air pollution damaging freshwater habitats and other ecosystem services;
- warmer rivers and lakes impacting on productivity and functioning of aquatic ecosystems;
- soil moisture deficits and erosion impacting biodiversity and soil carbon and increasing risk of wildfires;
- increased prevalence of invasive non-native species, pests and pathogens impacting on animal, plant and biodiversity;

- loss of climate space, with species unable to track climate change; and
- changes in the timing of seasonal events.

6.148 The UK Climate Change Risk Assessment 2017 (HM Government, 2017), confirmed that the following changes had already been recorded due to climate change:

- changes to the distribution of UK biodiversity;
- changes to the composition of terrestrial, coastal and freshwater ecosystems;
- northward shift in species distributions; and
- changes in the timings of seasonal events.

6.149 While there are potential effects of climate change on the future ecological baseline it is difficult to accurately predict and quantify the potential impacts of climate change on ecological systems.

6.150 The complexity of ecosystems and the myriad interactions between species and physical environmental characteristics present a challenge to modelling these systems.

6.151 In the context of the site, anthropogenic effects on biodiversity i.e. management and land use, are likely to be more significant to the future baseline conditions.

6.152 Qualitative assessments of observed biodiversity changes, and the likely biodiversity changes due to climate change have been defined in studies (Morecroft, M.D. & Speakman, L.,2015). Observations and predictions for habitats relevant to the site are described below.

Broadleaved woodland

6.153 Tree death following drought has been recorded at long-term monitoring sites. Those species most sensitive to this effect are beech, birch and sycamore. Such effects can lead to major changes in the composition and structure of woodland. Some tree species also show reduced growth rates during dry summers.

6.154 Changes in woodland composition are possible as a result of decreased rainfall and longer, warmer summers. The different responses of canopy and ground flora plant species may also lead to changes in woodland composition.

6.155 Additional effects may occur due to changes in pest and disease ranges and prevalence or the introduction of new pests.

Grassland

6.156 Increasing temperatures have promoted earlier spring greening of grasslands and a longer growing season which may be beneficial for plant species and their associated invertebrate assemblages.

6.157 However, decreased or less reliable summer rainfall could result in less plant biomass and changes in plant community species composition, favouring species adapted to warmer, drier conditions. This could in turn affect the abundance and species composition of the associated invertebrate assemblage.

6.158 Many grasslands are likely to remain similar in character with a temperature rise of a few degrees unless those grasslands are on the edge of their climatic range.

Ponds

6.159 Symptoms of eutrophication (excess nutrients leading to algal growth) have been shown to increase with warmer temperatures. Climate change may indirectly result in greater nitrogen deposition which will influence the severity of eutrophication.

6.160 Increased flooding and drought may be beneficial to maintaining pond biodiversity, however, may also result in ponds which are permanently drying up more frequently.

6.161 The direct effects of temperature increase will be less important unless there are large changes in temperature which would result in major changes in fish communities.

Faunal species

Bat

6.162 Juveniles are often more vulnerable than adults to extreme weather events (e.g. spring drought, flooding and cold winters). Therefore, there can be knock-on impacts on mammal populations. Persistent heavy rain can decrease flying insect prey availability for bats.

6.163 Higher summer rainfall has been associated with greater insect abundance, increasing survival rate of some bats species although the opposite effect is seen with drier springs and summers. Warmer winters resulting in reduced hibernation periods can reduce body condition, breeding success and survival rates.

Birds

6.164 Warmer winters since the 1990s have increased bird survival rates of many common and widespread bird species. Bird ranges in the UK have shifted north and warming has been associated with an increase in the diversity of bird communities, of generalist species populations.

6.165 Changes to invertebrate prey abundance and diversity due to changes in soil moisture and rainfall could impact on many bird species. Increased winter rainfall may adversely affect winter survival if it reduces prey availability.

Dormouse

6.166 Warmer winters can result in shorter hibernation periods for species such as dormouse, resulting in reduced body condition, breeding success and survival rates.

Badger

6.167 Droughts can reduce the availability of worms which constitute a significant prey species for badger.

6.168 Milder winters could result in increased food availability due to an earlier onset of spring, resulting in badger populations increasing.

Otter

6.169 Reduced water flow in rivers would adversely affect otters.

6.170 Warming of waters may result in changes to populations of fish prey.

Water Vole

6.171 Reduced water flow in rivers would adversely affect water voles.

6.172 Increased extreme weather events can have a disproportionate effect on mammals at key stages in their life cycle (e.g. during the mating period, pregnancy, weaning, dispersal and hibernation).

Great Crested Newt

6.173 Modelling indicates that some amphibians could expand their range northwards provided there is suitable habitat connectivity.

6.174 Low summer rainfall has potential to result in reduced survival of young.

Reptiles

6.175 Modelling indicates that some reptiles could expand their range northwards provided there is suitable habitat connectivity.

Invertebrates

6.176 Climate warming has resulted in northward range shifts of many southern and common British invertebrates and changes in butterfly communities. The impact of changes in temperature and precipitation varies between butterfly species, with the negative effects of warm wet winters greatest in species that overwinter as caterpillars or pupae.

6.177 Areas of climate suitability might increase for some species although species will vary in their capacity to benefit, especially in fragmented landscapes. Some invertebrate species may respond with behavioural or evolutionary adaptation to changing conditions. More extreme rainfall patterns are likely to affect flight periods and food availability for many insects.

Development Description

6.178 Please refer to Chapter 2 Proposed Development Description and the Design and Access Statement for the Proposed Development description. Alternative Layout

6.179 As described in Chapter 2: Proposed Development Description, the BESS is an integral part of the Proposed Development and has therefore been assessed as such within this ES chapter. The indicative BESS layout is shown on **Figure 2.14** – Indicative BESS Layout (Drawing no: BESS_LYT) and its components are set out in **Table 2.1** of Chapter 2: Proposed Development Description. Construction of the BESS will take approximately 6-9 months which will be independent of the overall construction programme and will be constructed at a later date.

6.180 As detailed in Chapter 2, there is potential that development of the BESS in this location may not materialise and therefore the Proposed Development design has built in flexibility to place solar panels in this location instead. The assessment contained within this chapter has assessed the Proposed Development in the context of the BESS being included as part of the design as the worst-case scenario.

Mitigation Measures Adopted as Part of the Proposed Development

Habitat Retention and Protection

6.181 The Proposed Development landscaping is shown on the Illustrative Landscape and Ecology Masterplan (**Figure 5.10**. The Illustrative Landscape and Ecology Masterplan includes measures to enhance biodiversity, including:

- Internal and boundary hedgerow reinforcement appropriate to the arable and pastural fields that would improve the site's existing field structure, enhancing biodiversity and habitats for local wildlife;
- Woodland edge scrub planting is proposed adjacent to existing areas of established woodland to improve connectivity and integration within the site; and
- Various meadow grassland mixes are proposed for different habitat creation that include a tussocky grassland for grazing beneath the solar PVs, woodland meadow for the connectivity of areas adjacent to existing woodland, wetland meadow of wet areas and a wildflower meadow.

6.182 The Proposed Development will retain the hedgerow network and the majority of semi-mature trees, maintaining the existing higher value biodiversity features over the lifetime of the Proposed Development in accordance with the Step-Wise Approach outlined in Planning Policy Wales 11 (as outlined in the October 2023 update to Section 6).

6.183 The Proposed Development has been designed taking into account Ecosystem Resilience and the DECCA framework (Welsh Government, 2021); relating to diversity, extent, connectivity, context and adaptability outlined in Planning Policy Wales 11. Habitats with higher species diversity will be maintained.

6.184 The Proposed Development will retain higher value habitats and areas with higher species diversity. Where habitat loss is unavoidable, the extent of the loss has been minimised.

6.185 New areas of habitat will be created to offset any loss and will be sensitively managed to provide a net benefit for biodiversity. The landscape proposals have taken into account the DECCA framework.

6.186 The retention of mature and semi-mature trees will preserve habitat with intrinsic value which would otherwise not be possible to re-establish over the lifetime of the Proposed Development. The perimeter fence has been specifically aligned to be outside the canopy spread of each of the hedgerow trees locally increasing the stand-off from field boundaries.

6.187 The hedgerow network will be retained, maintaining connectivity throughout the site.

6.188 Where the perimeter security fencing is installed, it will be set back from the hedgerow / top of ditch bank by 4m with an additional 6m buffer between the fencing and solar arrays to protect these habitats from adverse change during construction or once the solar farm is operational.

6.189 Openings for mammals will be provided at regular intervals through the provision of mammal gates along the base of the perimeter fencing to provide access points for badgers, and other mammals, allowing them to move around and through the operational solar farm. Two way lockable badger gates will be installed to allow closure of the gates during lambing season.

6.190 Pond P2 will be protected with a 10m stand-off between the perimeter fencing /edge of the working area and the pond margin, with the solar arrays located 16m from the pond. All other ponds will be over 60m from the working area.

6.191 There will be no construction, storage or access close to any of the ponds during construction.

6.192 There will be a minimum stand-off of 25m from all the canopy edges of each of the off-site woodlands (including Big Wood to the south).

6.193 Where possible, the temporary roads required for construction, operational maintenance and decommissioning of the solar farm are aligned to existing access points through hedgerows (excluding the southern construction access). Gaps in hedgerows will be widened where necessary to enable access for the vehicles required for installation and decommissioning. The temporary roads will be built up above the existing ground level in all of the root protection areas of trees and hedgerows.

6.194 The majority of the cabling associated with the Proposed Development will be laid underground via surface dug trenches of approximately 1m deep and 50cm wide and backfilled. These will utilise existing access tracks and road options wherever possible.

6.195 Measures will be undertaken to avoid the mixing of topsoil with sub soil during trenching to protect soil health, as outlined in the oCEMP and the oSRMP.

6.196 The cable route will avoid the wooded section of the River Clywedog, with the river crossing aligned to an existing bridge where the bankside vegetation is managed as amenity grassland, in close proximity to Bersham Lane.

6.197 The Proposed Development is a temporary and fully reversible with all equipment removed from site at the end of the installation's operational life (approximately 40 years). The methods used in construction (limited concrete) mean that remediation works following the removal of the panels and associated infrastructure are relatively minor and will return the site to its previous greenfield character.

Incorporated Landscaping

6.198 Areas of habitat which will be retained or created within the operational site are described below. Biodiversity aims for the site, management prescriptions and the monitoring schedule are provided in the LEMP (**Appendix 6.8**).

6.199 New areas of habitat will be created to offset the conversion of arable to grassland and the loss of a very small extent of improved grassland. The new habitat will provide a significant increase in habitats with biodiversity value, providing an overall net biodiversity benefit (Biodiversity Net Gain is outlined in **Appendix 6.9**). Habitats will be sensitively managed to promote their value for biodiversity.

Pasture

6.200 The solar arrays will be installed within the existing improved and poor semi-improved grassland fields. The arable fields will be sown with a wildflower grassland mixture and sheep grazing will be enabled to continue providing an efficient multi-use of land for renewable energy generation and agriculture, alongside enhanced habitats for biodiversity.

Tussocky Grassland

6.201 A 0.34ha section of grassland within the Biodiversity Enhancement Area, and sections of grassland between the perimeter fencing and around field boundaries will be managed as tussocky grassland.

6.202 The grassland will be managed with the objective of creating a patchy tussocky structure which will provide cover for amphibians, reptiles and small mammals. The habitat will provide niches for invertebrates, increasing invertebrate populations which will providing a foraging resource for a range of species. Ground nesting birds such as skylark and meadow pipit may also use the habitat for nesting.

6.203 The tussocky grassland will be managed through rotational cutting in September/October.

Wildflower Grassland

6.204 Wildflower grassland will be created within the Biodiversity Enhancement Areas. No solar arrays will be installed in these areas, and they will be fully stockproof enclosed by fencing /continuous hedgerows.

6.205 The existing arable fields will be stripped of rye-grass ley / crops and the topsoil removed. The fields will then be sown with a wildflower grassland mixture. Once the grassland has established it will be subject to low intensity sheep grazing to encourage the development of a species-rich wildflower grassland.

6.206 The status and structure of the created grassland will be subject to ongoing monitoring. All grazing agreements for fields within the Biodiversity Enhancement Areas will be fully modifiable over the lifetime of the solar farm to enable the stocking densities to be reduced or increased to meet biodiversity targets for the grassland. Grazing could be supplemented by periodic cutting/scarification as part of the management for this part of the site.

New Ponds

6.207 Three new wildlife ponds will be created within the Biodiversity Enhancement Area.

6.208 Selected native marginal plant species (water forget-me-not *Myosotis scorpioides*, great willowherb *Epilobium hirsutum*, and water mint *Mentha aquatica*) will be plug-planted into the unshaded pond margins to further increase the biodiversity value of the pond and provide egg-laying opportunities for newts.

6.209 Grassland areas adjoining the pond will be managed as tussocky grassland, a habitat favoured by amphibians providing dense cover and supporting prey species. Stockproof fencing will be installed around the pond and the grassland would be subject to low intensive management through periodic cutting in autumn to maintain grassland and prevent scrub encroachment. The grassland would be subject to rotational cutting with a third of the habitat cut no more than once every 3 years to maintain a minimum of 60% tall tussocky grassland and tall herb around the pond.

New Native Hedgerow

6.210 A significant extent of new native hedgerows comprising a mixture of native shrub species will be planted along the boundaries of the Biodiversity Enhancement Areas. The total length of the new hedgerow planting will be over 3.3km. Over time these will improve connectivity and become part of the network of hedgerows.

Hedgerow Infill Planting

6.211 Defunct and species-poor hedgerows will be subject to infill planting with a mixture of native shrub species. The planting once established will be managed to maintain dense structured hedgerows of higher value for wildlife. Infill planting will directly improve connectivity on boundaries where there are currently gaps.

Invertebrate Banks

6.212 Invertebrate banks will be created in the Biodiversity Enhancement Area at the north-west of the site. The banks will have south facing slopes constructed from stone and soil. Steep, bare earth sections will provide burrowing habitat for invertebrates. Management will seek to create a flower-rich open vegetation cover on the top of the bank with good populations of invertebrate foodplant species.

Dense Native Scrub

6.213 Dense native species scrub will be created in the Biodiversity Enhancement Area at the north-west of the site. The scrub will be managed to provide nesting and foraging habitat for birds.

Native Tree Planting

6.214 Native broadleaved trees will be planted throughout the Biodiversity Enhancement Areas, creating additional habitat with connection to existing woodland and hedgerows.

Winter Cover Crop

6.215 Sections of winter cover crop will be sown to provide sources of food for farmland bird species foraging within the site during winter.

6.216 A tailored mix of plants will be used comprising native seed bearing plants and/or non-native species with high seed productivity such as quinoa and kale.

6.217 The winter cover crops would be created by shallowly ploughing in early spring prior to the sowing of the crop. The cover crop plants will be left uncropped for 12 months and will provide food during each winter. Every spring over the lifetime of the Proposed Development all these areas will be shallowly ploughed and resown with the winter cover crop.

6.218 The control of any colonising injurious weeds (docks, thistles) will be an ongoing requirement for site management. If there is significant spread from the areas of cover crop but this would be through mechanical means with no unauthorised use of herbicides.

Assessment of Construction Effects

6.219 The potential for the following impacts during the construction stage have been assessed:

- Habitat loss
- Habitat disturbance or degradation
- Direct loss or injury of protected species
- Disturbance of protected species (lighting, noise, human activity and habitat fragmentation)

Statutory designated sites

6.220 There are four statutory designated sites within 10km of the Proposed Development, all of which are a considerable distance from the Proposed Development with the closest being Gatewen Marsh SSSI located over 1km from the Proposed Development.

6.221 The majority of these sites including Gatewen Marsh SSSI are designated for the habitats they include which will be unaffected by the Proposed Development.

6.222 Johnstown Newt Sites SAC and Stryt Las A'r Hafod SSSI are designated for their GCN populations. There are no direct wildlife corridors between the Proposed Development and the designations which are at the upper limit of distances GCN are known to travel at 1.69km and 1.75km from the site. The Proposed Development is relatively low impact and measures to mitigate potential adverse effects on GCN will be adopted as part of the Proposed Development as set out in the GCN Mitigation Strategy (**Appendix 6.10**). There are no anticipated effects of the Proposed Development on these designations in EIA terms.

6.223 Full assessment of the potential impact pathways resulting from the Proposed Development and each of the Natura 2000 sites and their qualifying features are provided in the shadow Habitat Regulations Assessment (HRA) report (**Appendix 6.7**).

Non-statutory designated sites

6.224 Higher Berse Marsh WS and Big Wood WS adjoin the boundary of the site while the Afon Gwenfro WS is located to the north beyond the B5430.

6.225 There will be a minimum 25m buffer between the Proposed Development and the boundaries of the designated sites which alongside the full implementation of environmental good practice by all the site contractor teams will prevent potential impacts from direct damage or pollution during construction. Measures to protect biodiversity are set out in the oCEMP (**Appendix 2.2**) and the LEMP (**Appendix 6.8**).

6.226 There are no anticipated effects of the Proposed Development on these designations in EIA terms.

Habitats

6.227 The majority of habitats within the site will be retained and protected. Measures which will be undertaken to protect retained habitats are provided in the LEMP (**Appendix 6.8**).

Arable

6.228 The installation of the solar arrays will result in the conversion of areas of arable to grazed grassland where the solar arrays are located.

6.229 New areas of winter cover crop will be created to provide replacement foraging habitat for wintering birds.

6.230 The arable habitat is considered to have negligible sensitivity. The magnitude of the permanent loss of existing areas is considered to be high. Overall the changes will result in a direct, long-term adverse effect of **minor significance**, which is not significant in EIA terms.

Grassland

6.231 Loss of improved and semi-improved grassland will be limited to localised areas for the construction of the access tracks (unsealed hardcore above a geotextile membrane) and solar array infrastructure.

6.232 The sensitivity of the improved and semi-improved grassland is considered to be negligible. The permanent loss of small areas of grassland is considered to result in a low magnitude adverse impact. This will result in a direct, long-term, effect of **negligible significance**, which is not significant in EIA terms.

Hedgerows and Ditches

6.233 Hedgerows and ditches will be protected with a minimum 5m stand-off. There will be localised cutting back of hedgerows to facilitate access through the site. A minimum 10m stand-off will be implemented around the drainage ditch to the north of the A525.

6.234 These habitats are considered to have up to medium sensitivity. The magnitude of the cutting back of hedgerows is considered to be low. This will result in a direct, long-term, adverse effect of **negligible significance**, which is not significant in EIA terms. There will be no effects on ditches.

Mature Trees

6.235 Mature trees within the fields and hedgerows will be retained and their roots protected.

6.236 The trees have low sensitivity. There are no anticipated effects on the mature trees and therefore no likely significant effect in EIA terms.

Other Off-site Habitats

6.237 Woodland adjoining the site will be protected by a minimum 25m buffer.

6.238 There is a 60m stand-off between the River Clywedog and perimeter fencing around the solar farm.

6.239 There will be a minimum 10m buffer between the solar arrays and pond P2. All other ponds are over 60m from the Proposed Development.

6.240 Root protection zones will be implemented around all mature boundary trees during construction.

6.241 The adjoining off-site habitats have up to county value and there will be no impacts on the off-site habitats. There are no anticipated effects on these habitats and therefore no likely significant effect in EIA terms.

Faunal Species

6.242 Where works requiring ecological supervision are required, a suitably experienced ecologist will be appointed by the Applicant. Works requiring ecological supervision are outlined in the LEMP (**Appendix 6.8**). Protective measures will be undertaken in relation to: bats, badgers, dormouse, breeding birds, great crested newt and reptiles, as described below.

6.243 The Proposed Development has been designed to avoid potential impacts on protected species and follows the Step-Wise Approach set out in Planning Policy Wales 11. Where there is potential for impacts on species, the potential magnitude has been minimised. Further mitigation will be implemented to reduced impacts.

6.244 Where habitat loss is unavoidable, new areas of habitat will be created to offset this. The inclusion of new habitat creation within the Biodiversity Enhancement Areas and the sensitive management of the site will provide a net benefit for biodiversity.

Bats

6.245 The Proposed Development may require the removal of several trees within the site. None of the trees which could be affected have features which could support roosting bats.

6.246 Avoidance of impacts on larger trees has been built into site design through the retention and protection including root protection zones (RPZs). The alignment of the perimeter fence has stand-offs from the canopies to avoid branches overhanging the perimeter fence which could require the removal of branches as well as the RPZs.

6.247 There will be no artificial lighting during construction which could affect the use of trees for roosting bats. The value of the site for roosting bats will remain unchanged with no impacts arising from the proposals.

6.248 The incorporation of all the boundary hedgerows, watercourses and ditches will retain a network of flight lines and foraging habitat of value to bats. The assemblage of species using the site should remain unaffected.

6.249 There is therefore predicted to be no adverse effects on bat roosts or bat activity during construction and no likely significant effects in EIA terms.

Badgers

6.250 During the construction phase following good working practice, precautionary measures will be implemented to prevent harm to badgers and other wildlife.

6.251 The installation of the Proposed Development should require very few if any open excavations, as all the infrastructure is temporary with an approximate lifespan of 40 years. Should any excavations be left open overnight, ramps or boards should be securely placed to allow animals to escape.

6.252 All hazardous materials brought onto site should be safe stored in designated areas that cannot be accessed by wildlife.

6.253 Regularly spaced openings in the base of the perimeter fence will allow wildlife to move through the site, and between the site and surrounding areas.

6.254 The site has low value for badgers and there will be no impacts on badger during the construction phase. There will be no significant effects in EIA terms on badgers as a result of the Proposed Development.

Otter

6.255 The solar arrays and associated infrastructure will be located within the open grassland fields which otter are very unlikely to travel through.

6.256 The 60m stand-off between the River Clywedog and solar panels will protect the habitat and any otter present within the river during construction works within the fields.

6.257 There will be a 25m stand-off from between woodland and the site. As the area of woodland adjoining the site and River Clywedog lacks cover and is frequented by dog walkers it is unlikely to be used by otters.

6.258 The cable route will cross the River Clywedog 200m east of the closest otter laying up area. The cable will be installed by horizontal directional drilling. The crossing is located in an area where the river runs parallel to Bersham road. The banksides in this area adjoin mown grassland within residential gardens and roadside verges. The area lacks dense vegetation or other features which would provide cover for otter.

6.259 The preferred cable route option follows a road parallel to a small shallow stream for 300m. The stream adjoins pasture fields to the north and the road to the south, with a narrow fringe of trees, hedgerows and taller grassland. Given the small size of the stream and lack of extensive dense vegetation along the banksides the habitat has low value for otter.

6.260 The river and stream would remain as corridors along which otters could move through the landscape. There will be no barriers to otter movement along the watercourses throughout the works.

6.261 The otter population in the adjoining wooded river corridor had medium sensitivity. Given the distance between areas of high value habitat for otter and the Proposed Development areas, and there will be no impacts on the species during construction. There will be no significant effects in EIA terms on otters as a result of the Proposed Development.

Water Vole

6.262 The 60m buffer around the River Clywedog and tributary stream and the 10m buffer around drainage ditches within the site will provide protection for water vole if present within the habitat.

6.263 The site is considered to have up to local value for water vole. There will be no impacts on the species and no significant effects in EIA terms on water vole as a result of the Proposed Development.

Dormouse

6.264 The Proposed Development will use existing tracks and field gateways to help protect the hedgerow network.

6.265 Localised widening of existing access into fields will be limited to the removal of short sections of managed hedgerow next to farm gates during construction with subsequent replacement planting.

6.266 The proposed minimum stand-off of 5m between the working area and all hedgerows and the 25m from the broadleaved woodland would protect dormice from harm or disturbance if present within retained on-site hedgerows.

6.267 There is potential for the hedgerows in combination with the off-site woodland to support a dormouse population of up to medium sensitivity. Based on hedgerow removal being overseen by an ecologist, the impact during construction will be negligible and the effect will be of **negligible significance** and therefore not significant in EIA terms.

Hedgehog

6.268 The use of the site by hedgehog would not be adversely affected by the installation of the solar arrays or associated infrastructure.

6.269 Connectivity through and around the site will be maintained by the inclusion of regular gaps in perimeter fencing.

6.270 The site has negligible sensitivity for hedgehog and there will be no impacts on the species. There will be no significant effects on hedgehog in EIA terms as a result of the Proposed Development.

Breeding Bird Assemblage

6.271 The retention of the hedgerow network and mature trees and the protection of the off-site woodland will protect the nesting habitats of the majority of species recorded as breeding or potentially breeding within the site and adjoining habitat.

6.272 The Proposed Development will result in the loss of arable land which provides habitat for ground nesting birds, however this habitat is widespread in the surrounding area.

6.273 The short-grazed pasture which comprises the majority of the site will be retained, though the context will change following the installation of solar panels and could deter ground nesting species.

6.274 Very low numbers of skylark and meadow pipit have been recorded nesting in the site and potential impacts on populations of these species would therefore be limited. The breeding bird population is considered to have a low sensitivity. There is potential for a direct, long-term adverse impact on ground nesting birds of low magnitude. The effect would have negligible significance.

6.275 Existing nesting opportunities for all species other than skylark and meadow pipit will remain unchanged.

6.276 Installation of solar arrays between September and February inclusive would avoid impacts on any ground nesting birds. Works outside of this would have potential to impact on nests, with the core breeding season being between May and July.

6.277 The breeding bird assemblage at the site has low sensitivity and there is potential for a low magnitude impact on breeding birds during construction. Based on installation of the solar arrays and any associated works being either outside of the breeding season or being subject to inspections by an ecologist for ground nesting birds, the impact during construction will be negligible and the effect would be of [negligible] significance and not significant in EIA terms.

Wintering Bird Assemblage

6.278 Winter food availability is expected to be a key factor in the continued use of the site by wintering populations of farmland birds.

6.279 There will be a temporary loss of foraging habitat during the construction phase, with winter cover crop planted to offset this once established. The species recorded on arable land within the site will be foraging across a wide area within the site making up a small proportion of the total area of managed farmland in the locality.

6.280 There is potential for changes to the wintering bird assemblage using the site following the changes to the context of the winter crop habitat.

6.281 New areas of winter cover crops (wild bird seed mix including quinoa and kale) will contribute to the sources of food available in the operational site over winter to offset the loss of arable land. The areas will be planted with a wide range of crops to maximise the value of the habitat as a foraging resource for wintering birds.

6.282 The tussocky grassland created around the site margins and within the Biodiversity Enhancement Areas will support a range of wildflower and grass species and would be a new foraging resource for some species that use the site in winter.

6.283 The tussocky field margins and new ponds are expected to be associated with a source of insect prey species.

6.284 The wintering bird assemblage is considered to have up to a medium sensitivity. The changes to the foraging habitat are considered to have up to a low magnitude impact overall. There is potential for a long-term, adverse effect which would have up to **minor significance** which is not significant in EIA terms.

Great Crested Newt

6.285 During construction, the majority of works will take place within the arable and short-grazed grassland where GCN are unlikely to be present.

6.286 The majority of direct habitat loss will be of arable land which will be converted to grassland. The arable land will be subject to very short-term disturbance as part of the enabling works with the fields sown with a pasture seed mix to establish grassland. The disturbance would be equivalent to, or less than, activities associated with arable landscape management.

6.287 Localised areas of improved grassland will also be lost where infrastructure for the solar farm and winter cover crop will be created.

6.288 The core habitat associated with breeding GCN populations is within 50m of the open water. The likelihood of individual GCN being impacted from construction activities will decrease with distance from the breeding ponds.

6.289 There is a 60m buffer around pond P3 where a small GCN population has been recorded and 70m around pond P5 which has been dry during surveys but which could support a small GCN population. The buffers avoid the potential for disturbance to the waterbodies during construction.

6.290 Solar panel supports will be piled into the short-grazed semi-improved grassland and recently sown grassland. The physical disturbance of ground associated with this will be minor. There is a very low likelihood of individual GCN being present in the grassland away from the field margins.

6.291 There are unlikely to be below ground hibernation features within the fields and there would be no predicted impacts on reptiles or amphibians if works requiring ground disturbance such as piling are completed between mid-November and the end of January. Outside of this period when the weather conditions are suitable there is potential for individuals to be active, moving above ground and foraging in terrestrial habitats.

6.292 A small amount of work will be undertaken in areas of taller vegetation such as at field entrances where there is a low chance of reptiles and amphibians being present. Precautionary working measures will be implemented during the construction phase which will provide protection for reptiles and amphibians if present.

6.293 The sensitivity of the GCN population is considered to be low. In the absence of precautionary working measures there could be a low magnitude impact during construction. This is considered to have up to a minor direct, short-term, adverse effect of **negligible significance** which is not significant in EIA terms.

Reptiles

6.294 The arable farmland and short grazed pasture have very low value for reptiles and the potential for impacts in these habitats is very limited taking into account the stand-offs being built into the design to protect hedgerows, watercourses and woodland.

6.295 The areas of longer grassland around field margins have potential to support reptiles.

6.296 The precautionary working measures implemented to protect GCN during the construction phase will additionally provide protection for reptiles if present.

6.297 The sensitivity of the reptile population is considered to be negligible. In the absence of the above measures there could be a low magnitude impact during construction. This is considered to have up to direct, short-term, minor adverse effect of negligible significance which is not significant in EIA terms.

Invertebrates

6.298 The existing site has limited value for invertebrates and the potential for impacts is very limited taking into account the stand-offs being built into the design to protect ponds, hedgerows, mature trees, watercourses and off-site woodland. The site is considered to have negligible sensitivity for invertebrates and there will be no impacts on invertebrates. There will be no effects with significance in EIA terms.

Assessment of Operational Effects

6.299 The potential for the following impacts during the operational stage have been assessed:

- Habitat loss
- Habitat disturbance or degradation
- Direct loss or injury of protected species
- Disturbance of protected species (lighting, noise, human activity and habitat fragmentation)

Statutory designated sites

6.300 Given the nature of the Proposed Development and distance to statutory designated sites, there are no impact pathways of the operational development which would affect the habitats or species for which statutory designated site are designated. There are no anticipated operational effects of the Proposed Development on statutory designated sites and therefore there will be **no effects of significance** in EIA terms.

6.301 Full assessment of the potential impact pathways resulting from the Proposed Development and each of the Natura 2000 sites and their qualifying features are provided in the shadow Habitat Regulations Assessment report (**Appendix 6.7**).

Non-statutory designated sites

6.302 Higher Berse Marsh WS and Big Wood WS adjoin the boundary of the site while the Afon Gwenfro WS is located to the north beyond the B5430.

6.303 Following heavy rainfall and during cleaning operations there will be water run-off from the panels. This will infiltrate into the grassland beneath panels. There will be a 25m stand-off between the

Proposed Development boundary and WSs and additional 10m buffers between solar panels and the Proposed Development boundary.

6.304 The non-statutory designated sites have medium sensitivity. The substantial stand off will protect the designated sites from potential impacts during the operation. There will be no effects with significance in EIA terms.

Habitats

Operational Phase

6.305 The management of Biodiversity Enhancement Areas will be designed to create higher value habitats than the existing arable. The management will seek to create a structurally diverse grassland with good floral diversity, areas of dense scrub and ponds with good water quality supporting a range of aquatic plants.

6.306 The existing and newly created pasture beneath the solar panels will be 'over sailed' by between 25% and 40% resulting in shading for part of the day. The existing grassland is short grazed and species poor with negligible sensitivity. There will be no impacts on the habitat during operation and there are no negative effects on the habitat value anticipated as a result of the Proposed Development. The creation and sensitive management of habitats will provide a significant biodiversity gain, as demonstrated in the Biodiversity Net Gain Assessment (**Appendix 6.9**).

6.307 The proposals will increase the range of habitats present within the site, creating new wildlife niches.

6.308 The retention, creation and enhancement of habitats will be supported by the implementation of management for biodiversity, monitoring of the outcomes, and where necessary remedial measures to address any shortfalls.

6.309 The proposals have potential to result in long-term, positive effects on hedgerow, grassland and pond habitats. The hedgerows have low sensitivity and there is considered to be a negligible beneficial impact of **negligible significance** on hedgerows.

6.310 The ponds will have up to medium sensitivity. The magnitude of the impact is considered to be low beneficial and ponds and would result in an effect of **minor beneficial significance**.

6.311 The grasslands will have negligible sensitivity. There will be a low beneficial impact on the wildflower and tussocky grassland resulting in a **minor beneficial significance**. There will be no impacts on the poor semi-improved and improved grasslands.

6.312 There will be no impacts on field ditches, mature trees or offsite woodland, watercourses or ponds during the operational phase.

6.313 None of the effects are significant in EIA terms.

Faunal Species

Bats

6.314 There will be no permanent artificial lighting during operation which could affect the use of trees for roosting. The value of the site for roosting bats will remain unchanged with no impacts arising from the proposals.

6.315 During operation, the value of habitats for bats is expected to increase with the Biodiversity Enhancement Areas, tussocky grassland field boundaries and new pond all expected to be associated with a higher abundance of invertebrates than the short-grazed grassland and arable field habitat in the existing site.

6.316 The Proposed Development is predicted to have no adverse effects on bat roosts or bat activity. There is potential for a positive effect in terms of increased foraging levels of activity across the operational Proposed Development compared to the existing site. Bat populations using the site are considered to have up to low sensitivity. There is considered to be potential for a low magnitude impact. The predicted effect is long-term and **beneficial with negligible significance**. This will not be significant in EIA terms.

Badgers

6.317 The operational activities will primarily relate to the maintenance of the panels and infrastructure and have no potential to impact on badger setts.

6.318 Regularly spaced openings in the base of the perimeter fence will allow wildlife to move through the site, and between the site and surrounding areas.

6.319 Habitat creation within the site has potential to result in a small increase in the value of the site as a foraging area for badger.

6.320 The site has low sensitivity for badgers. There will be no impacts and **no significant effects** on badgers during operation as a result of the Proposed Development. This will not be significant in EIA terms.

Otter

6.321 All habitats with value for otter will be retained and protected around the Proposed Development during the operation of the solar farm and the connectivity between habitats will be retained.

6.322 The sensitivity of the otter population using the offsite watercourses is medium. Given the distance between areas of high value habitat for otter and the site, there will be no impacts and **no significant effects** on the status of the local otter population, or individual otters, as a result of the Proposed Development. This will not be significant in EIA terms.

Water Vole

6.323 The protection of the off-site watercourses, ponds and their immediate context would ensure that the habitats would have the potential to be colonised by water vole during the operation of the solar farm.

6.324 The site has up to low sensitivity for water vole. There will be no impacts and **no significant effects** on water vole as a result of the Proposed Development. This will not be significant in EIA terms.

Dormouse

6.325 The stand-offs from hedgerows and woodland will protect the context of the hedgerows and woodland and ensure that their potential to be used by dormouse populations will remain unaffected over the lifetime of the Proposed Development. The site has up to medium sensitivity for dormouse. The planting of new hedgerow and shrubs and the enhancement of existing hedgerows has potential to result in a low magnitude impact on dormouse. The predicted effect is long-term and beneficial with **negligible significance**. This will not be significant in EIA terms.

Hedgehog

6.326 The use of the site by hedgehog would not be adversely affected throughout operation of the Proposed Development.

6.327 The new hedgerow and tussocky grassland habitat will provide new habitat for hedgehog and there is potential for an increase in populations of invertebrate prey.

6.328 Connectivity through and around the site will be maintained by the inclusion of regular gaps in perimeter fencing.

6.329 The site has negligible sensitivity for hedgehog. There is potential for hedgerow creation and enhancement to result in a low magnitude impact. This would result in a long-term positive effect on **negligible significance** which is not significant in EIA terms.

Breeding Bird Assemblage

6.330 During the operational phase wildflower and tussocky grassland within the Biodiversity Enhancement Areas will be managed through a much reduced grazing intensity by sheep and will provide habitat which may support ground nesting birds. Other fields will continue to be grazed to a short height.

6.331 The new habitats within the Biodiversity Enhancement Areas and around field margins will provide increased foraging opportunities. New scrub, hedgerows and the sensitive management of hedgerows will increase the extent of nesting habitat.

6.332 The Proposed Development will remain unlit during construction and throughout operation with no change in the context of field boundaries and would avoid the potential for adverse changes in bird behaviour.

6.333 The breeding bird population is considered to have a low sensitivity. There is potential for the habitat management to result in a low magnitude impact. Overall, it is considered that during operation there is potential for a long-term positive effect with **minor significance**, which is not significant in EIA terms.

Wintering Bird Assemblage

6.334 The adoption of rotational hedgerow management will increase the availability of fruit for wintering birds at least during early winter. Over time the value of the hedgerows and habitats within the Biodiversity Enhancement Area would be expected to increase in value for wintering birds.

6.335 The wintering bird assemblage has up to medium sensitivity and there will be no impacts on wintering birds during operation. There will be **no significant effects** on wintering birds as a result of the operation of the Proposed Development. This will not be significant in EIA terms.

Great Crested Newt

6.336 The majority of the site will remain as grazed semi-improved pasture.

6.337 The creation of a pond, scrub and tussocky grassland within the Biodiversity Enhancement Areas and across the site will provide new habitat of value to GCN.

6.338 Over the lifetime of the Proposed Development the retained and created habitats should at least maintain the current status of the breeding population in P3.

6.339 Hedgerow infill planting and the creation of tussocky grassland around the perimeters will also increase connectivity for GCN across the wider site.

6.340 The enhancements and management will contribute to the favourable conservation status of great crested newt over the 40-year lifetime of the Proposed Development.

6.341 The great crested newt populations are considered to have low sensitivity. There is potential for a low magnitude impact. This would result in a long-term, beneficial effect of **minor significance**, which is not significant in EIA terms.

Reptiles

6.342 The conversion of arable fields into grassland subject to low intensity grazing would increase the extent of habitat with value for reptiles within the site, in particular slow-worm and grass snake, and would contribute to their favourable conservation status.

6.343 Habitats within the Biodiversity Enhancement Areas will provide extensive areas of higher value habitats which are absent in the existing site.

6.344 The impact during operation will benefit reptile species, if there are any populations within or adjoining the site. The reptile populations are considered to have negligible sensitivity. There is considered to be a potential low magnitude impact. This has potential to result in a long term, beneficial effect of **minor significance**, which is not significant in EIA terms.

Invertebrates

6.345 Stand-offs from ponds, hedgerows, mature trees, watercourses and off-site woodland will protect existing habitats with value for invertebrates.

6.346 The Biodiversity Enhancement Areas which will be managed to provide biodiversity benefits will provide long-term resources for invertebrates both in terms of niches within the habitat structure and sources of nectar and pollen. New areas of habitat with value for invertebrates to be created within the site include invertebrate banks designed to provide nesting opportunities, ponds, scrub, wildflower and tussocky grassland.

6.347 The invertebrate populations the site will support are considered to have negligible sensitivity. There is potential for a low magnitude impact. This would result in a long-term, beneficial effect with **minor significance**, which is not significant in EIA terms.

Assessment of Decommissioning Effects

6.348 Predicted effects upon biodiversity during the decommissioning stage of the Proposed Development would be equivalent to those experienced during construction for the duration of the phase. The potential for impacts during the decommissioning phase are therefore considered to be consistent with those identified for the construction phase:

- Habitat loss
- Habitat disturbance or degradation
- Direct loss or injury of protected species
- Disturbance of protected species (lighting, noise, human activity and habitat fragmentation)

6.349 Potential environmental impacts during the decommissioning phase will be managed through implementation of management measures to be specified ahead of the decommissioning phase commencing. These would be specified in decommissioning environmental management plans and/or method statements.

6.350 Full implementation of environmental good practice by all the site contractor teams will prevent potential impacts from direct damage or pollution during decommissioning. Similar to construction environmental management measures, such measures which are likely to be required during decommissioning include:

- No use of artificial lighting
- Appropriate stand-offs to be incorporated between working areas and sensitive receptors (e.g. Ancient Woodland, River Clywedog etc.)
- Works to be undewrtaken between September and February inclusive
- Dood working practices and precautionary measures to be implemented to reduce impact on species and habitats.

6.351 Overall, the decommissioning of the Proposed Development is not anticipated to cause any significant effects upon biodiversity.

Further Mitigation

Great Crested Newt

6.352 A GCN Mitigation Strategy has been prepared, setting out the potential impacts and mitigation for the Proposed Development (**Appendix 6.10**).

6.353 Precautionary species protection measures will be implemented during the excavations for foundations for all infrastructure, construction of new sections of road and piling of the solar panel supports designed to protect individuals and maintain the favourable conservation status of GCN in the locality.

6.354 The majority of the construction activity will be located within arable and short grazed pasture where there is a very low likelihood of GCN being present.

6.1.1 The GCN Mitigation Strategy will be fully implemented during the installation of the solar arrays, access tracks and infrastructure so that the Proposed Development avoids any harm to GCN. A Welsh Government species mitigation licence for GCN will be obtained for the site and species protection implemented in advance of works which have the potential to affect GCN.

6.355 Precautionary working will be implemented for all areas of habitat of higher potential value for GCN including any disturbance of longer field margin grassland. This will include the phased removal of taller vegetation and protection of potential hibernacula during the hibernation season.

6.356 Wherever practical, existing established field margin grassland will be left undisturbed. The precautionary working would involve fingertip searches by an ecological clerk of works (ECoW) where foraging habitat will be disturbed during the active season.

6.357 Species protection and the creation of new grassland, hedgerows and a new pond will maintain and promote the favourable conservation status of the GCN population over the lifetime of the Proposed Development.

Bats

6.358 Where tree removal is required, affected trees will be surveyed by a suitably experienced ecologist to check for potential roost features. Should potential roost features be present, further surveys will be undertaken to confirm whether these are in use by bats.

6.359 A Welsh Government Bat Mitigation Licence would be sought from Natural Resources Wales if there is potential for a roost to be affected prior to any works being undertaken on the trees.

Dormouse

6.360 Where short sections of hedgerow removal (up to 10m) are required to widen the access for vehicles transporting the Proposed Development infrastructure onto the site precautionary working measures will be undertaken. Given the low impact of the Proposed Development on the hedgerow network and low likelihood of dormouse being present within the habitat, works on hedgerows will be undertaken following a non-licenced method statement. Checks for dormice nests will be undertaken in the section affected followed by the gradual removal of hedgerow overseen by an ECoW. A replacement section of hedge will be replanted with native species following the completion of construction.

6.361 A Welsh Government Dormouse Mitigation Licence would be sought from Natural Resources Wales should dormouse be encountered during the works and any works with the potential to affect the species postponed until the licence is granted.

Nesting birds

6.362 Prior to the felling of shrubs and trees during the breeding bird season inspections would be made for the presence/absence of nesting birds. Where active nest sites are found they must remain undisturbed until the young have fledged and dispersed from the nest site.

Wintering birds

6.363 Areas of wild bird cover crop will be resown annually and left unharvested so that the site continues to provide foraging habitat for wintering birds.

Future Monitoring

Construction Phase

6.364 The implementation of commitments within the oCEMP, including safeguarding of root protection areas (RPAs), all species protection measures, as well as general environmental safeguarding will be documented in an environmental compliance log which will be available for the LPA to review on request. The site contractor would be responsible for maintaining the log and keeping a photographic record of key activities. The ECoW or other nominated person would log details of all elements of the ecological watching brief and related work.

Operational Phase

6.365 The LEMP (**Appendix 6.8**) provides specifications for the management actions for each habitat and includes an annual work programme for the contractor to implement (**Appendix 6.8**).

6.366 During the operational life of the solar farm, the management actions will be designed to achieve the biodiversity objectives defined in the LEMP (**Appendix 6.8**). The management approach will maintain flexibility and appropriate remedial actions will be specified and programmed should any

circumstances resulting from the management or operation of the Proposed Development lead to adverse effects on habitats or species of principal importance and/or species of conservation concern.

6.367 Habitats within the site will be subject to periodic monitoring following their creation and the start of management for biodiversity. Monitoring will assess the extent to which management actions are achieving the defined objectives and target habitat condition (structure, diversity, size), and identify any negative trends to be addressed through additional management and/or remedial actions.

6.368 Grasslands will be surveyed in relation to the ratio of grasses/herbs; species composition, positive and negative indicator species, variation in sward height, average number of plant species per square metre, and the extent of bare ground. Specific targets will be set for each grassland habitat type: meadow grassland (cut 2-4 times annually outside of the flowering season) and long tussocky grassland (cut on rotation with each area cut once every 3 years), tussocky pasture (subject to low intensity grazing), and short pasture (subject to standard stocking density).

6.369 The grassland structure in the fields with low intensity grazing will be used to define the stocking density. Grazing agreements in these areas will be flexible to allow the ecologist to define the numbers of livestock required. These fields will be physically separated from pasture fields subject to a standard grazing regime with stockproof fencing to be installed and maintained.

6.370 Hedgerows should be maintained in good condition with the target habitat being: over 2m in height and width, a dense structure throughout without gaps in the base, continuous field boundaries (excluding field gates) and with the shrubs and trees in good health. Each hedgerow should be cut back on rotation with only one side of a hedge cut once every two years and both sides of a hedgerow should not be cut in the same year. All rotational hedgerow cutting should be in early winter leaving fruits as a food source for birds in autumn.

6.371 The management objective for the new pond will be to maintain at least 50% of the pond area as open water unshaded by tree and shrub canopies, with populations of mixed marginal vegetation with less than 20% cover of dominant emergent plants, and good water quality.

6.372 The monitoring will be reported annually for the first 5 years to define the outcomes of habitat creation and enhancement. In longer term a monitoring report will be prepared after each round of monitoring to be undertaken at least once every 5 years over the operational life of the Proposed Development.

6.373 Each monitoring report should be used to inform future management decisions, suggesting modifications to management where the desired outcomes are not being achieved.

6.374 The process of habitat management for biodiversity supported by monitoring will be long term commitments that will continue over the lifetime of the operation.

Alternative Layout

6.375 In the event that the BESS is not built out and this land is used for additional solar panels instead, the biodiversity effects would be equal to or less than those currently presented in this chapter given that the BESS elements are more permanent features within the overall Proposed Development. As a result, this assessment currently presents a worst-case and therefore allows the flexibility for either option to be brought forward in the future.

Accidents and/or Disasters

6.376 Good practice measures will be implemented from the outset of enabling works and throughout construction.

6.377 Pollution prevention and other environmental protection measures will be built into the working practices for all relevant construction activities. These measures will follow relevant guidance to minimise the risk of accidents with the potential to adversely affect ecological receptors. Measures will include construction fencing to protect retained trees and woodland adjoining the site, tree protection (consistent with BS5837(2012)), dust control, surface water control, spill prevention and management, and designating secure refuelling and storage areas.

Potential Changes to the Assessment as a Result of Climate Change

6.378 As described in paragraphs 6.103 – 6.133 which identify reasonable worst-case scenarios for climate change, potential changes to habitats and populations as a result of climate change are difficult to predict. During operations anthropogenic factors such as site management are likely to be more significant for the biodiversity of the site and it is very unlikely that climate change would significantly affect the findings of this assessment.

Assessment of Cumulative Effects

6.379 The following developments described in **Appendix 4.7** were assessed for cumulative effects:

- Land South Of, Berse Road, Caego, Wrexham, LL11 6TP (P/2023/0221) – erection of 47 dwellings and associated infrastructure. This Proposed Development site is approximately 500m to the north of the Plas Power site (north of the A525).
- Lower Berse Farm, Ruthin Road (A525), Wrexham (pre-application) – strategic development of 1,500 homes. This Proposed Development site is approximately 270m to the east of the Plas Power site (east of the A483).
- Legacy National Grid Substation, Bronwylfa Road, Talwrn, Wrexham, LL14 4HY (P/2023/0175) – Installation and operation of battery storage facility and ancillary development. This Proposed Development site adjoins the preferred cable route option.
- Legacy National Grid Substation, Bronwylfa Road, Talwrn, Wrexham, LL14 4HY (preapplication) – 1,025 MW Energy Storage System. This Proposed Development site is approximately 430m to the south of the preferred cable route option.
- DNS/3237973 – Bersham Energy Plant. This Proposed Development site is approximately 1,000m to the south-east of the preferred cable route option.

Habitats

6.380 The Proposed Development will provide a net biodiversity benefit through the retention of higher value habitats within the site and creation of new habitats with biodiversity value.

6.381 The nearby Proposed Developments include some of the same habitat types present within the site (arable, grassland and hedgerows). Each of the developments assessed are separated from the Proposed Development. There is a minimum distance of 270m between the assessed developments and solar farm arrays within the Proposed Development where the majority of construction work will

be undertaken and there are therefore no impact pathways identified which would result in cumulative impacts.

6.382 The preferred cable route option and the three alternative variation options (Option 1, 2 & 3) adjoins the battery storage facility and ancillary development at the Legacy National Grid Substation, Bronwylfa Road, the cable installation will have a small working area and will not result in significant changes to the habitat along the cable route. As such there is negligible potential for cumulative impacts.

6.383 Given the low impact nature of the Proposed Development, separation from nearby developments and creation of new habitats there is negligible potential for cumulative impacts with nearby Proposed Developments. There will therefore be **no effects** which are significant in EIA terms.

Species

6.384 The Proposed Development avoids adverse impacts on the majority of protected species and potential cumulative impacts would therefore primarily relate to breeding and wintering birds.

6.385 It is assumed that nearby residential and BESS developments will result in the loss of the majority of arable habitat within these developments.

6.386 During construction, there will be a loss of arable habitat within the Proposed Development. Given the low numbers of ground nesting birds (skylark, meadow pipit) the potential impact of the Proposed Development and cumulative impacts are negligible.

6.387 The Proposed Development is located in a rural area and the loss of arable within the site will have up to a minor effect on wintering birds. Given the provision of new foraging habitat in the Proposed Development and continued wide availability of foraging habitat within the wider landscape, the potential for cumulative impacts is limited and will not adversely affect the local populations of any species.

6.388 There will be **no effects** on species which are significant in EIA terms.

Inter-relationships

6.389 In identifying and assessing the impacts of the Proposed Development on terrestrial ecology, the inter-relationships with the environmental impacts identified in other ES chapters have been considered.

6.390 The information set out in Chapter 2: Proposed Development has provided the basic information upon which to base the assessment of the effects of the proposals as a result of land take, operation and construction.

6.391 There are inter-relationships between the ecology assessment and the landscape scheme (Chapter 5), hydrological aspects of design (Chapter 8) and the construction programme. The proposals have evolved with input from each of the technical disciplines to inform the site layout and landscape scheme. The landscape scheme has been deigned to provide value for biodiversity while satisfying the LVIA requirements and the hydrology of the site. The output from the collaborative design is described in the built-in mitigation section and considered in the assessment of impacts and effects.

6.392 There are **no inter-related effects** anticipated beyond those effects identified thus far in the assessment. This will therefore not be significant in EIA terms.

Summary of Effects

6.393 **Table 6.5** presents a summary of effects on ecological resources for the construction, operational and decommissioning phases. None of the effects identified during construction, operation and decommissioning are significant in EIA terms.

Designated Sites

6.394 There is no potential for impacts on statutory designated sites or non-statutory sites designated for specific habitat types.

6.395 All statutory and non-statutory designated sites are located over 1km from the Proposed Development. A 25m stand-off will protect Big Wood WS and Higher Berse Marsh WS from all construction activities. Good environmental practice will need to be implemented during the landscaping (grassland creation) in the buffer zone.

6.396 No potential impacts have been identified for any other designated sites within the 2km area around the site.

Habitats

6.397 The sensitivity of habitats within the site is considered to be low to negligible and adjoining the site is up to medium. Stand-offs will be implemented around higher value habitat including field boundaries and adjoining woodland, watercourses and waterbodies. The substantial separation of the working area from the River Clywedog will avoid potential impact pathways.

6.398 The biodiversity value of the site will be maintained and enhanced through sensitive design enabling the retention of all higher value features and the creation of new habitats with value for wildlife. The Proposed Development would result in the conversion of low value habitat, primarily arable farmland to grazing pasture with neutral grassland boundaries.

6.399 The Proposed Development should result in a **minor positive effect of significance** in the context of the site.

6.400 The magnitude of change will be up to **low or no change** for the majority of habitats, and high for arable habitat.

6.401 It is considered that overall the Proposed Development will result in a direct, permanent, long-term, beneficial, residual effect of up to **minor significance**.

Species

6.402 The design has taken into account wildlife present within and adjoining the site.

6.403 There will be minimal temporary loss of grassland and hedgerow habitat suitable for GCN, reptiles, dormouse and nesting birds.

6.404 The wooded habitats adjacent to the site will not be adversely affected by the development proposals with no potential impact on their use by otter. Confirmed resting places on the River Clywedog lie a significant distance from the boundary of the development. The otter population for which the River Clywedog forms part of their territory will not be affected by the proposals.

6.405 Very low numbers of ground nesting birds may be displaced into adjoining arable. The potential requirement for the felling of individual trees to enlarge access points within the site has a low likelihood of affecting a bat roost.

6.406 The sensitive timing of works and species protection measures will protect any populations present. Trees and all hedgerows will be retained protecting the potential value of the site for roosting bats.

6.407 Replacement foraging habitat for wintering birds will be created. The creation of new ponds, hedgerows, tussocky grassland and wildflower grassland will benefit a range of species including GCN. Grassland and pond creation alongside hedgerows will maintain flightlines and have the potential improve the value of the site for foraging bats.

6.408 The long-term management with biodiversity objectives, supported by targeted monitoring, is designed to deliver benefits for habitats and species.

6.409 Overall, the Proposed Development will develop higher value for biodiversity than the existing site with the potential for a **minor positive effect of significance** in the context of the site.

Table 6.5: Summary of Likely Environmental Effects on Biodiversity

Receptor	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact	Significance of effect	Significant / Not significant
Construction phase						
Designated Sites						
Johnstown Newt Sites SAC and Stryt Las A'r Hafod SSSI	Very High (International)	None	n/a	No change	No change	Not significant
Other statutory designated sites	Very High (International) –	None	n/a	No change	No change	Not significant
Non-statutory designated sites	Medium (County)	None	n/a	No change	No change	Not significant
Habitats						
Arable Fields	Negligible (Site)	Permanent habitat loss Creation of areas of winter cover crop	Long term	High	Overall Minor adverse	Not significant
Improved Grassland	Negligible (Site)	Very localised loss	Long term	Low	Negligible adverse	Not significant
Poor Semi-improved Grassland	Negligible (Site)	Very localised loss	Long term	Low	Negligible adverse	Not significant
Hedgerows	Up to medium (County)	Very localised cutting back in some areas	Long term	Low	Negligible adverse	Not significant
Field Ditches	Up to medium (County)	None	n/a	No change	No change	Not significant
Mature Trees	Up to low (Local)	None	n/a	No change	No change	Not significant
Offsite Broadleaved Woodland	Up to medium (County)	None	n/a	No change	No change	Not significant
Offsite Watercourses	Up to medium (County)	None	n/a	No change	No change	Not significant

Receptor	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact	Significance of effect	Significant / Not significant
Offsite Ponds	Up to medium (County)	None	n/a	No change	No change	Not significant
Species						
Bat - Roosts	Up to low (Local)	None	n/a	No change	No change	Not significant
Bats - Foraging	Up to low (Local)	None	n/a	No change	No change	Not significant
Water Vole	Up to low (Local)	None	n/a	No change	No change	Not significant
Otter	Up to medium (District)	None	n/a	No change	No change	Not significant
Badger	Low (Local)	None	n/a	No change	No change	Not significant
Dormouse	Up to medium (County)	Temporary disturbance and localised loss of dormouse habitat during hedgerow cutting back	Short term	Negligible	Negligible adverse	Not significant
Hedgehog	Negligible (Site)	None	n/a	No change	No change	Not significant
Breeding birds	Low (Local)	Temporary disturbance of habitat used by ground-nesting birds	Medium term	Low	Negligible adverse	Not significant
Wintering Birds	Up to medium (County)	Loss of arable foraging habitat Provision of foraging resources through creation of winter cover crop, tussocky and wildflower grassland, new hedgerows and dense scrub	Long term	Low	Minor adverse	Not significant
GCN	Low (Local)	Potential disturbance or damage in absence of control measures during localised habitat removal	Short term	Low	Negligible adverse	Not significant
Reptiles	Negligible (Site)	Potential disturbance or damage in absence of control measures during localised habitat removal	Short term	Minor	Negligible adverse	Not significant
Invertebrates	Negligible (Site)	None	n/a	No change	No change	Not significant

Receptor	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact	Significance of effect	Significant / Not significant
Operational phase						
Designated Sites						
Johnstown Newt Sites SAC and Stryt Las A'r Hafod SSSI	Very High (International)	None	n/a	No change	No change	Not significant
Other statutory designated sites	Very High (International) –	None	n/a	No change	No change	Not significant
Non-statutory designated sites	Medium (County)	None	n/a	No change	No change	Not significant
Habitats						
Wildflower Grassland	Negligible (Site)	Creation of new areas of wildflower grassland	Long term	Low	Minor beneficial	Not significant
Tussocky Grassland	Negligible (Site)	Creation of new areas of tussocky grassland	Long term	Low	Minor beneficial	Not significant
Poor Semi-improved Grassland	Negligible (Site)	None	n/a	No change	No change	Not significant
Improved grassland	Negligible (Site)	None	n/a	No change	No change	Not significant
Hedgerows	Up to medium (County)	New hedgerow planting and infill planting	Long term	Negligible	Negligible beneficial	Not significant
New ponds	Up to medium (County)	Creation of new pond	Long term	Low	Minor beneficial	Not significant
Field Ditches	Up to medium (County)	None	n/a	No change	No change	Not significant
Mature Trees	Up to low (Local)	None	n/a	No change	No change	Not significant
Offsite Broadleaved Woodland	Up to medium (County)	None	n/a	No change	No change	Not significant

Receptor	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact	Significance of effect	Significant / Not significant
Offsite Watercourses	Up to medium (County)	None	n/a	No change	No change	Not significant
Offsite Ponds	Up to medium (County)	None	n/a	No change	No change	Not significant
Species						
Bat - Roosts	Up to low (Local)	None	n/a	No change	No change	Not significant
Bats - Foraging	Up to low (Local)	Creation of new potential flightlines through the planting of new hedgerows and infill planting along defunct hedgerows Potential increase in invertebrate prey species	Long term	Low	Negligible beneficial	Not significant
Water Vole	Up to low (Local)	None	n/a	No change	No change	Not significant
Otter	Up to medium (County)	None	n/a	No change	No change	Not significant
Badger	Low (Local)	None	n/a	No change	No change	Not significant
Dormouse	Up to medium (County)	Increased extent of hedgerows and scrub and enhancement to existing hedgerows increasing dormouse habitat.	Long term	Low	Negligible beneficial	Not significant
Hedgehog	Negligible (Site)	Increased extent of hedgerows and enhancement to existing hedgerows increasing hedgehog habitat.	Long term	Low	Negligible beneficial	Not significant
Breeding birds	Low (Local)	Increase in tussocky and wildflower grassland, dense scrub and hedgerow habitat providing increased foraging resources and nesting opportunities Potential increase in invertebrate prey species	Long term	Low	Minor beneficial	Not significant
Wintering Birds	Up to medium (County)	None	n/a	No change	No change	Not significant
GCN	Low (Local)	Increase in tussocky grassland and hedgerow habitat and potential increase in invertebrate prey species New ponds providing suitable breeding habitat	Long term	Low	Minor beneficial	Not significant

Receptor	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact	Significance of effect	Significant / Not significant
Reptiles	Negligible (Site)	Increase in tussocky grassland and hedgerow habitat and potential increase in invertebrate prey species	Long term	Low	Minor beneficial	Not significant
Invertebrates	Negligible (Site)	Increase in tussocky grassland and hedgerow habitat	Long term	Low	Minor beneficial	Not significant

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7 CULTURAL HERITAGE

Introduction

7.1 This chapter assesses the likely significant environmental effects of the Proposed Development on the historic environment. It assesses the likely significant effects to known and potential buried archaeological remains within and in proximity to the site, as well effects on archaeological and built heritage assets in the surrounding area.

Assessment Methodology

7.2 The assessment of likely significant environmental effects on cultural heritage resources within the site has been conducted in line with the latest and most comprehensive guidance provided in the "Design Manual for Roads and Bridges" (DMRB) published by the Highways Agency in 2007 (updated 2020), particularly LA106 Cultural Heritage Assessment (updated Jan 2020) and LA104 Environmental Assessment and Monitoring (Revision 1 August 2020), and the Chartered Institute for Archaeologists Standard and Guidance for historic environment desk-based assessment (updated October 2020). Whilst the DMRB guidance was produced specifically for use in highways projects, the approach outlined in it is frequently used for other project types and its use was welcomed by the Planning Inspectorate in its scoping response. These documents do not provide a prescriptive approach to assessment but identify principles and good practice that have been applied in the methodology for this assessment.

Legislative and Planning Policy Context

7.3 National (UK-wide) legislation regarding archaeology, including scheduled monuments, is contained in the Ancient Monuments and Archaeological Areas Act 1979, amended by the National Heritage Act 1983 and 2002, and updated in April 2014.

7.4 Where any development may affect certain designated heritage assets, there is a legislative framework (UK-wide) to ensure proposed works are developed and considered with due regard to their impact on designated heritage assets. This extends from primary legislation under the Planning (Listed Buildings and Conservation Areas) Act 1990.

7.5 The relevant legislation in this case extends from section 66 of the 1990 Act which states that special regard must be given by the decision maker, in the exercise of planning functions, to the desirability of preserving or enhancing listed buildings and their setting.

7.6 The Well-being of Future Generation (Wales) Act 2015 places duties on public bodies requiring them to act in accordance with the 'sustainable development principles'. The Act also establishes well-being goals which include achieving 'a Wales of vibrant culture and Welsh language', described as 'a society that promotes and protects culture, heritage and the Welsh language'. The Act lays down the principle that a properly protected, conserved and enhanced historic environment can improve the quality of life and well-being for everyone.

7.7 The Historic Environment (Wales) Act 2016 was given Royal Assent in March 2016. This Act provides the legislative framework for managing the historic environment in Wales. Accompanying the Act is new policy and guidance in the form of a TAN specific to the Historic Environment (TAN24, see below), and changes to PPW. This legislation and guidance supersede the previous Welsh Office Circulars which formed the basis of historic environment policy in Wales.

7.8 A new Historic Environment (Wales) Act 2023 was given Royal Assent on June 14th 2023. The purpose of this Act is to consolidate existing Welsh and UK-wide legislation in one place. The 2023

Act consolidates enactments in or made under the following:

- the Historic Buildings and Ancient Monuments Act 1953;
- Parts 1 and 3 of the Ancient Monuments and Archaeological Areas Act 1979;
- Parts 14 and 15 of the Town and Country Planning Act 1990;
- the Planning (Listed Buildings and Conservation Areas) Act 1990;
- Part 5 of the Planning and Compulsory Purchase Act 2004;
- the Historic Environment (Wales) Act 2016.

7.9 Although the Act has received Royal Assent, it will not come into force until supporting secondary legislation has been made and guidance and administrative documents have been revised and updated to reflect its passage. It is expected that the Act will come into force in the latter part of 2024.

7.10 Future Wales – the National Plan 2040 is the national development framework, setting the direction for development in Wales to 2040. It addresses key national priorities, including sustaining and developing a vibrant economy, achieving decarbonisation and climate-resilience, developing strong ecosystems and improving the health and well-being of communities.

7.11 Policy 18 of Future Wales – 'Renewable and Low Carbon Energy Developments of National Significance' – makes reference to the historic environment, with paragraph 6 stating that renewable developments will be permitted as long as 'there are no unacceptable adverse impacts on statutorily protected built heritage assets'.

7.12 The Welsh Government has published PPW, currently updated to Version 12 from February 2024 (PPW12). This sets out the land use planning policies of the Welsh Government. It is supplemented by a series of TANs. Procedural advice is given in circulars and policy clarification letters.

7.13 Chapter 6 of PPW12, entitled 'Distinctive and Natural Places', has a section entitled 'The Historic Environment' (section 6.1 - pp. 125-131) which provides policy for planning authorities, property owners, developers and others on the conservation and investigation of heritage assets. A more complete discussion of PPW Chapter 6 and policies in the Local Plan is given in the Planning Background and Development Plan Framework section in Appendices 6.1 and 6.2.

7.14 Under the Hedgerow Regulations 1997, hedgerows are deemed to be historically important if they are more than 20m long and over 30 years old and if they meet at least one of these criteria:

- they mark all or part of a parish boundary that existed before 1850;
- they mark an archaeological feature of a site that is a scheduled monument or noted on the Historic Environment Record;
- they mark the boundary of an estate or manor or looks to be related to any building or other feature that's part of the estate or manor that existed before 1600; and/or
- they are part of a field system or looks to be related to any building or other feature associated with the field system that existed before the Inclosure Acts (that is before 1845).

7.15 In practice (and following case law), hedgerows are deemed Important under the above regulations if they can be demonstrated to exist on the appropriate pre-1845 parish tithe or enclosure map.

7.16 As the study site lies within the Wrexham County Borough Council area, the statutory development plan comprises the Wrexham Unitary Development Plan 1996-2011, adopted in February 2005. In particular, Policies EC4, EC7, EC9 and EC11, are relevant to the historic environment.

7.17 The Council have also approved a series of Local Planning Guidance Notes which amplify LDP policy. Local Planning Guidance Note No 4 – Conservation Areas has been referred to in the production of this report. The Bersham Conservation Area Assessment and Management Plan (adopted December 2009) has also been referred to in the production of this report.

Relevant Guidance

7.18 PPW is additionally supported by guidance published by Cadw. This includes Heritage Impact Assessment in Wales (2017) and Setting of Historic Assets in Wales (2017).

7.19 The '*Conservation Principles, Policies and Guidance for the Sustainable Management of the Historic Environment in Wales'* published by Cadw in March 2011 provides the basic principles under which all subsequent guidance has evolved. The six principles expressed are:

- Historic assets will be managed to sustain their values.
- Understanding the significance of historic assets is vital.
- The historic environment is a shared resource.
- Everyone will be able to participate in sustaining the historic environment.
- Decisions about change must be reasonable, transparent and consistent.
- Documenting and learning from decisions is essential.

Definition of the historic environment

7.20 The historic environment is defined in TAN 24 (at para. 1.7) as:

"All aspects of the environment resulting from the interaction between people and places through time, including all surviving physical remains of past human activity, whether visible, buried or submerged, and deliberately planted or managed."

Definition of Heritage Assets

7.21 Heritage assets are defined by Cadw (March 2011) and TAN 24 (2017) as:

"An identifiable component of the historic environment. It may consist or be a combination of an archaeological site, an historic building or area, historic park and garden or a parcel of historic landscape. Nationally important historic assets will normally be designated."

7.22 A Designated Heritage Asset is considered to be a: World Heritage Site, Scheduled Monument, Listed Building, Protected Wreck Site, Registered Park and Garden, Registered Battlefield or Conservation Area. In Wales, areas of landscape have been designated and included in the non- statutory Register of Landscapes of Historic Interest in Wales.

Significance

7.23 Significance in relation to heritage policy considerations is defined as '*The sum of the cultural heritage*

values' (Cadw 2011, 38). Heritage values may be categorized as evidential, historical, aesthetic and communal (ibid. 10).

Setting

7.24 Guidance on the assessments of impact on the settings of heritage assets is provided by Cadw in '*Setting of Historic Assets in Wales'* (May 2017). This provides a 4-stage process for determining if any impact on the settings of historic assets would arise from a Proposed Development, and how it could be mitigated if impacts are identified.

7.25 The Chartered Institute for Archaeologists provides standards and guidance for a range of archaeological assessment activities, the most relevant of which are:

- Standard and guidance for desk-based assessment (2014, updated 2017); and
- Standard and guidance for geophysical survey (2014, updated 2020).

Study Area

7.26 A study area of 1km beyond the site boundaries has been used for assessment of the potential for hitherto unknown archaeological remains to be present within the site. A study area extending 1km is widely accepted as being appropriate in rural contexts for the assessment of archaeological potential. It generally provides sufficient background data to support the assessment without gathering large amounts of extraneous data with no direct bearing upon the archaeological potential of the site.

7.27 An initial search radius of 5km has been used to identify potential impacts on the settings of designated heritage assets. Review of the ZTV established that there will be very limited views of the Proposed Development at distances greater than 3km (**Figures 5.2 & 7.1, Appendix 7.1, Figure 2d**). At such distances, the Proposed Development will be seen in general views in the context of a landscape that includes extensive modern development. Consequently, following this initial consideration, it was concluded that a study area extending 3km was appropriate for the identification and assessment of likely significant effects.

Baseline Methodology

7.28 The following baseline studies and surveys have been undertaken:

- Archaeological desk-based assessment (RPS 2019, updated September 2023) (**Appendix 7.1**)
- Built Heritage Statement (RPS 2019, updated September 2023) (**Appendix 7.2**)
- Geophysical Survey (SUMO 2021) (Appendix A within ES **Appendix 7.1**)
- Trial Trenching (Oxford Archaeology 2024) (**Appendix 7.3**)

7.29 All work was carried out in accordance with Chartered Institute for Archaeologists standards and guidance.

Consultation

7.30 Consultation has taken place with the planning archaeologists at Clwyd-Powys Archaeological Trust (CPAT) and with Cadw. This is detailed in **Table 7.1.**

Table 7.1: Consultation Responses Relevant to this Chapter

Date	Consultee and Issues Raised	How/ Where Addressed
June 2020	**Cadw (Screening Response)**	
	Noted that the current design has responded to concerns expressed in 2019 regarding the proposed development's potential impact on *Scheduled Monuments DE131 Cadwgan Hall Mound, and DE132 Offa's Dyke: Cadwgan Hall Section, extending from River Clywedog to the Railway and particularly in regard to Scheduled Monument DE180 Offa's Dyke: Section in Plas Power Park*… *These changes have reduced the likely impact of the proposed development on the historic environment to a level which is not of sufficient impact to require an EIA to be produced. However, the proposed development is still likely to have an adverse impact on the settings of a number of the designated historic assets identified above and also on non-designated historic assets. Consequently any application for this development will need to be accompanied by a desk-based historic environment assessment including information on the scale of these impacts.*	An archaeological desk-based assessment and Built Heritage Statement have been prepared and are presented here as **Appendices 7.1-2**. Both documents have informed the assessment of likely significant effects on the settings of designated and non-designated historic assets undertaken in this Chapter.
July 2020	**Clwyd-Powys Archaeological Trust (CPAT) (Screening Response)** CPAT made the following comments on the previous design:	
	1. Zone C should be removed from the development proposal to protect the setting of the scheduled dyke.	Zone C has been removed.
	2. In Zone D pull the red boundary back to the east from the edge of Big Wood by at least 100m and preferably as far as the track to preserve the setting of the scheduled dyke.	Zone D (now Zone C) has been pulled back approximately 400m from Big Wood.
	3. Geophysics of all fields not impacted by the prior extraction activity to determine the subsurface potential.	Geophysical survey of all such areas has been completed. The results are contained in **Appendix 7.1**
	4. The proposal will need to assess the impacts of any electrical connection route to the grid.	Potential impacts of the grid connection have been assessed.
	In respect of the current design CPAT advised that pre-determination geophysical survey of areas not previously disturbed by mining operations would be required and that this might result in additional pre-determination evaluation and layout alterations. A significant impact is not likely owing to the potential for preservation in situ.	Geophysical survey of all such areas has been completed. The results are contained in **Appendix 7.1**

	There may be a setting impact upon *Grade II listed Plas Power Estate buildings (notably the stables) within the park even though many are screened by woodland and this needs to be assessed. The visual impact is not likely to be significant with appropriate screening and layout adjustments.*	Impact has been assessed.
November 2020	**Cadw (Scoping Response)**	
	Recommended that the scope of the updated Built Heritage Assessment should be extended to include all designated historic assets identified in Annex A to their scoping response.	In line with the relevant guidance, the assessment has taken a staged approach to the assessment of potential impacts relating to setting, the first stage being: Identify the historic assets that might be affected by a proposed change or development. This has been informed by a ZTV and site visits. Only those assets where potential impacts were identified have been carried through to assessment. No likely significant effects on the remaining assets are anticipated.
	The updated Archaeological Desk-Based Assessment should include the results of the geophysical survey.	The geophysical survey has been included in the DBA.
November 2020	**CPAT (Scoping Response)**	N/A
	We confirm that the suggested content of the cultural heritage assessment is fit for purpose, proportional to the type and scale of development and meets our requirements set out in the pre-application consultations and at the screening stage. We agree with the elements of the assessment which are to be scoped out.	
May 2023	**CPAT**	
	Based on the results of the geophysical survey, development should be excluded from Area 14, which includes archaeological features 2 and 3 and possible archaeological features 4 and 6 to allow for their preservation in situ.	Area 14 has been removed from the Proposed Development – these features will be preserved in situ.
July 2023	**Cadw (Addendum to Scoping Response)**	
	There is a need to add the requirement for the geophysical survey to be completed for all of the proposed development area and that archaeological evaluation will need to be carried out on any potentially significant features detected in the geophysical survey	Geophysical survey has been undertaken for all areas of the site that have not been disturbed previously Appendix 7.1. Trial trenching was subsequently undertaken of anomalies thought to potentially be of archaeological interest. This work was undertaken in accordance with a Written Scheme of Investigation (WSI) agreed with CPAT. The results are presented in full in **Appendix 7.3** and have been

		incorporated into the assessment.
	A Stage 1 assessment should be carried out for the designated heritage assets listed in Appendix A.	A Stage 1 assessment informed by the ZTV and site visits have been undertaken.
September 2023	**CPAT**	
	Trial trenching might be required to test geophysical anomalies categorized as 'Uncertain'. The scope of trenching should be confirmed following completion of the geophysical survey. Following completion of the geophysical survey, CPAT were consulted regarding the scope of the trial trenching. It was requested that trenching of the anomalies interpreted as possible archaeology and those of uncertain origin that might represent settlement remains be undertaken.	The scope of trial trenching was discussed with CPAT and a WSI was agreed (February 2024). Trenching was undertaken in line with the WSI and the results have been incorporated into the assessment. They are presented in full in **Appendix 7.3**.
September/ October 2023	**Cadw**	
	Cadw confirmed that if the grid connection did not pass through a scheduled area Scheduled Monument Consent (SMC) would not be required. Cadw advised that SMC might be required if the grid connection were to be routed under the Scheduled Monument using Horizontal Directional Drilling (HDD) and that an SMC Application should be lodged with sufficient information to determine if SMC is required.	A draft SMC application will be submitted with the application.
April 2024	**Cadw** Chapter 7 Cultural Heritage is incomplete, as the results of an evaluation of potential archaeological features, identified by geophysical survey, has not been included in it. The cable route has not been confirmed with two routes currently being proposed. If the southern route is chosen, it will cross scheduled monument DE132 Offa's Dyke: Cadwgan Hall Section, extending from River Clywedog to the Railway. It is currently proposed to make this crossing by the use of horizontal directional drilling. Whilst the intention of using this method to cross the scheduled monument is not to have a direct impact on it, scheduled monument consent will need to be granted before this can be carried out.	The results of an evaluation of potential archaeological features, identified by geophysical survey, was not included in the consultation version of the ES, however, the consultation version ES did confirm that a scheme of evaluation was underway. The evaluation has since been completed. It established that the potential archaeological features identified by the geophysical survey were of little or no archaeological interest. The ES has been updated to reflect the results of the evaluation. Scheduled Monument Consent is applied for as a secondary consent of the DNS application so that if Cable Route Option 1 is pursued, the necessary consents will be in place to allow construction to commence.

		Engagement with Cadw in respect of the draft SMC has taken place.
April 2024	**Woodland Trust** Noted the presence of Offa's Dyke and that the design had evolved to remove it from the site and stated that 'it is imperative that the sanctity and connection of Offa's Dyke to the wider landscape is maintained.'	The Proposed Development has been set back from Offa's Dyke by a minimum distance of 200m to minimise potential impacts relating to its setting. It is considered that the Proposed Development will have no significant effects in respect of Offa's Dyke.

Assessment Criteria and Assignment of Significance

7.31 This subsection describes the approach taken to identifying the magnitude of an impact and the sensitivity/value of receptors.

Receptor Sensitivity/Value

7.32 The sensitivity of a heritage asset has been determined with reference to its relative importance. In the first instance importance has been assigned based on designation. Where non-designated assets are being considered, the non-statutory criteria for designation provided in TAN24: The Historic Environment (Welsh Government 2017) have been referred to.

Table 7.2: Criteria for Assessing Sensitivity of Heritage Receptors

Sensitivity	Descriptors
High	World Heritage Sites. Scheduled Monuments and archaeological sites of demonstrable schedulable quality & importance. Protected Wreck Sites Registered Battlefields. Grade I and II* listed buildings. Grade I and II* registered parks and gardens.
Medium	Local Authority designated sites and their settings. Undesignated sites of demonstrable regional importance Grade II listed buildings. Grade II registered parks and gardens Registered Historic Landscapes. Conservation Areas.

Low	Sites with specific and substantial importance to local interest groups. Sites whose importance is limited by poor preservation and poor survival of contextual associations. Locally Listed Buildings and buildings of some quality in fabric or historic association (i.e. non-designated heritage assets).
No Importance /Negligible	Sites with no surviving archaeological or historical component.
Unknown	Importance cannot be ascertained.

Magnitude of Impact

7.33 The magnitude of impact is assessed with reference to the degree of change in the receptor's cultural significance. Guideline criteria for assessing magnitude of predicted change on cultural heritage resources are given in **Table 7.3** below. Both physical and setting effects are considered as harm to significance can result through loss to or development within the setting of a heritage asset.

Table 7.3: Criteria for the Appraisal of Magnitude of Impact on Heritage Receptors

Magnitude	Definition
High	Total or substantial loss of the significance of a heritage asset. Substantial harm to a heritage asset's setting, such that the significance of the asset would be totally lost or substantially reduced (e.g. the significance of a designated heritage asset would be reduced to such a degree that its designation would be questionable; the significance of an undesignated heritage asset would be reduced to such a degree that its categorisation as a heritage asset would be questionable). (Adverse).
	Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality (Beneficial).
Medium	Partial loss or alteration of the significance of a heritage asset. Harm to a heritage asset's setting, such that the asset's significance would be materially affected/considerably devalued, but not totally or substantially lost. (Adverse).
	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality (Beneficial).

Low	Slight loss of significance of a heritage asset. This could include the removal of fabric that forms part of the heritage asset, but that is not integral to its significance (e.g. the demolition of later extensions/additions of little intrinsic value). Some harm to the heritage asset's setting, but not to the degree that it would materially compromise the significance of the heritage asset. Perceivable level of harm, but insubstantial relative to the overall interest of the heritage asset. (Adverse).
	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring (Beneficial).
Negligible	A very slight change to a heritage asset. This could include a change to a part of a heritage asset that does not materially contribute to its significance. Very minor change to a heritage asset's setting such that there is a slight impact not materially affecting the heritage asset's significance. (Adverse).
	Very minor benefit to or positive addition of one or more characteristics, features or elements (Beneficial).
No change	No change to a heritage asset or its setting or no loss or alteration of characteristics, features or elements contributing positively to or detracting from cultural significance.

Significance of Effects

7.34 The sensitivity of the receiving environment, together with the magnitude of impact, defines the significance of the effect on the cultural heritage receptor. The significance of effect has been established with reference to the matrix set out in **Table 7.4.** The environmental effect outlined below represents the effect on the cultural significance of the heritage assets without mitigation. Where significant effects are predicted mitigation has been proposed and the residual effect assessed. A significance of effect of 'major' or 'moderate' would be considered to equate to significant effects highlighted in the context of EIA Regulations

7.35 This process is not quantitative; rather, it relies upon professional judgement at each step. The factors considered in informing these judgements and in arriving at the various rankings and magnitudes of impact are observable facts (i.e., numbers of assets, special relationships, designations, impacts). This matrix approach is not intended to mechanise judgement on the significance of effect, but to act as a check to ensure that judgements regarding sensitivity, magnitude of impact and significance of effect are reasonable and balanced, to allow for professional judgement.

Table 7.4: Criteria for Assessing Significance of Effect

Sensitivity of receptor	Magnitude of impact				
	High	**Medium**	**Low**	**Negligible**	**No Change**
High	Major Adverse	Moderate Adverse	Minor Adverse	Negligible	No Effect
Medium	Moderate Adverse	Moderate to Minor Adverse	Minor Adverse to Negligible	Negligible	No Effect
Low	Minor Adverse	Minor Adverse to Negligible	Negligible	Negligible	No Effect
No Importance/ Negligible	Negligible	Negligible	Negligible	Negligible	No Effect

7.36 Effects of Major or Moderate significance are considered significant in EIA terms.

Limitations of the Assessment

7.37 With regard to archaeology, the assessment of the scale of effects is based on extensive professional experience gained from project work across Wales and the rest of the United Kingdom.

7.38 The information presented in this ES chapter and the technical appendices (Appendix 7.1) provides an indication of below ground archaeological assets present or likely to be present, rather than a definitive list of all assets likely to be present, as the full extent of below ground archaeological assets cannot be known prior to further site-specific archaeological field investigation.

7.39 The principal limitation to the assessment of effects upon below ground heritage assets is the nature of the archaeological resource, which is buried and therefore not visible. This means it can be difficult to accurately predict the presence and likely sensitivity of below ground heritage assets, and the likely impact (and resultant effects) of the Proposed Development upon such assets. This has been substantially addressed through a geophysical survey of the entire site, excluding those areas that are known to have been disturbed previously by the opencast colliery and the grid connection routes and subsequent trial trenching. The geophysical survey appears to have worked well except in Area A and, to a lesser extent, Area B. In these two areas there is magnetic disturbance, probably relating to the spreading of green waste, which in Area A is likely to have obscured any anomalies of archaeological origin and in Area B may have obscured such anomalies. Given the quality of the results and the corroboration provided by the trial trenching, the assessment of archaeological potential is relatively certain, accepting the inherent limits of archaeological evaluation methods.

7.40 With regard to built heritage (**Appendix 7.2**), there is some limitation to the assessment in that potential intervisibility between the site and built heritage assets may vary to some degree due to seasonal changes for intervening tree cover and planting. This potential limitation is considered to be a low risk, however, as the ZTV takes into account substantive screening and hence provides a reliable indication of intervisibility.

7.41 It is concluded that the limitations outlined above are not likely to materially affect the conclusions of the assessment or the mitigation measures proposed.

Assessment Parameters

7.42 As described in Chapter 2: Proposed Development Description, the BESS has therefore been assessed as such within this ES chapter. The indicative BESS layout is shown on **Figure 2.12** – Indicative BESS Layout and its components are set out in **Table 2.1** of Chapter 2: Proposed Development Description. Construction of the BESS will take approximately 6-9 months which will be independent of the overall construction programme and will be constructed at a later date. As detailed in Chapter 2, there is potential that development of the BESS in this location may not materialise and therefore the Proposed Development design has built in flexibility to place solar panels in this location instead. The assessment contained within this chapter has assessed the Proposed Development in the context of the BESS being included as part of the design. In the scenario that the BESS is not built out and this land is used for additional solar panels instead, the cultural heritage effects would be equal to or less than those presented in this chapter as the solar panels would result in less ground disturbance and be no more visible in the landscape than the BESS. As a result, this assessment currently presents a worst-case scenario and therefore allows the flexibility for either option to be brought forward in the future.

Baseline Environment

7.43 The site has been studied for its below ground archaeological potential, and potential effects on the settings of designated archaeological and built heritage assets in the surrounding area. This section is summarised from the results of those baseline studies, which included desk-based assessment, site visits, and field evaluation.

7.44 The baseline studies established that there are no designated archaeological or built heritage assets (of High sensitivity) within the main body of the site. However, the southern potential grid connection route crosses the line of the scheduled Offa's Dyke (DE132), whilst the northern route passes through a break in the scheduled area, where the dyke is crossed by a road. The northern route lies immediately to the north of Cadwgan Hall Mound (DE131).

7.45 Within the 3km study area there are (**Figure 7.1**):

- 44 Scheduled Monuments;
- 287 Listed Buildings;
- Six Conservation Areas; and
- Two Registered Historic Parks and Gardens.

7.46 Using the ZTV (**Figure 7.1**) and ground-truthing site visits, a number of designated heritage assets have been identified as potential receptors. (see **Figure 7.1**). These are itemized in **Table 7.5**. and comprise:

- 10 Scheduled Monuments
- 11 separate Listed Buildings
- One Conservation Area and its associated Listed Buildings

7.47 The HER contains one entry for the site relating to ridge and furrow earthworks identified from lidar data. No visible traces of ridge and furrow earthworks survive in this location; the area in which this

was recorded is ploughed and any earthworks that may have been present have been effectively removed. An area of ridge and furrow earthworks does survive, however, at the western fringe of the Site, south of the site of Plas Power, an area of upstanding ridge and furrow has been identified by the current survey.

7.48 The geophysical survey has recorded anomalies interpreted as possibly representing archaeology and anomalies that were categorized as uncertain. Trial trenching targeting the anomalies of potential archaeological interest found that these predominantly related to variations in the natural geology and had no archaeological interest. The features that were encountered were small to medium-sized ditches and gullies and a single posthole. With the exception of one ditch that contained Post-Medival or later pottery and one that correlated with a Post-Medieval field boundary, the features were undated. The features are thought to be agricultural in function and to have very little archaeological interest, of limited value at a local level. T These are considered to be of Negligible sensitivity.

7.49 Some hedgerows within the site are potentially important under the Hedgerow Regulations. These would be considered as of Low sensitivity.

Summary of Heritage Receptors

7.50 The detailed descriptions, cultural significance and settings of the receptors are presented in the Archaeological Desk-Based Assessment (**Appendix 7.1**) and the Built Heritage Assessment (**Appendix 7.2**), as appropriate, and summarised below.

Table 7.5: Cultural Heritage Receptors.

Receptor	Location	Summary Description	Summary Cultural Significance	Sensitivity
Ridge and furrow recorded in one small area of the Site, of possible Medieval or Post-Medieval date	Within the Site. Area C: South of Plas Power	Isolated fragment of ridge and furrow earthworks.	Limited historic illustrative value as a visible fragment of the Medieval agricultural landscape. Isolated fragment with little complexity and hence of local importance and low sensitivity.	Low (Local)
Agricultural features identified through archaeological evaluation (geophysical survey and trial trenching).	Within the site	Linear features and a post hole, for the most part undated and thought to be of agricultural function. The two examples that have been dated are Post-Medieval or later.	The cultural significance of these features relates entirely to their potential as sources of archaeological data. This potential is very slight and of limited value at a local level. They are considered to be of negligible sensitivity. .	Negligible
Historic Hedgerows	Within the site, western and northern parts.	The hedgerows within the Site appear on tithe maps dating to the 1840s and hence meet the criteria for consideration as historic hedgerows.	The hedgerows within the site are the incomplete remains of the 19th century and earlier field system. They have historic illustrative value, but are a common feature type and are considered to be of local importance.	Low (Local)
Bersham Ironworks (SM DE189)	50m S	The Scheduled Monument takes in the upstanding and buried remains of Bersham Ironworks. These were	The Scheduled Monument's significance derives from its historic interest as an example of an ironworks established before	High

		established in about 1715, possibly as early as the 1670s. From 1753 the ironworks produced cannon. A large steam engine was installed for pumping water around the furnace water wheel, and a number of waggonways to the works were constructed. Bersham dramatically increased in size, reaching its peak c.1795. Decline set in soon afterward with the establishment of Brymbo ironworks nearby. The works were finally sold in 1812. The octagonal cannon foundry (NPRN 40427, Grade II*, 1586), probable fettling shop (Grade II*, 16539), and a boring mill (NPRN 24854) later converted into a corn mill (NPRN 24853, Grade II 16538) survive as do other substantial remains, including lengths of wooden railway and a furnace (NPRN 34053). Associated are two weirs (NPRNs 34404 and 33629) and the former accounts house (NPRN 26752).	the Industrial Revolution that became a key centre of production. It is associated with a significant innovator in the iron industry John Wilkinson, who developed new methods of cannon manufacture, which greatly increased accuracy and reliability, that were later applied to cylinder production for steam engines and hence played a key role in the Britain's military and industrial development. The Scheduled Monument is of high sensitivity.	
Offa's Dyke - Overview	-	The Dyke is a large linear earthwork that is roughly followed by the current border between England and Wales. The structure is named after the 8th century king of the Saxon kingdom of Mercia, and although its precise purpose is unknown, it is assumed it was intended to mark a territorial boundary from inception rather than to serve a defensive function. The overall length of the Dyke is approximately 120km, and sections of it have been constructed at different times. It is up to 20m wide and consists of a raised linear earthwork and a flanking	The dyke's significance derives from: Its inherent value as the longest boundary monument and one of the earliest such monuments in Europe and the largest Early Medieval structure in Britain. Surviving elements of the Early Medieval landscape are exceptionally rare. It has substantial archaeological potential and hence evidential value as the dyke and associated features and structures may yield archaeological and palaeoenvironmental data that would add substantially to understanding of the	High

		ditch. The earthwork is up to 2.4m high.	settlement and economy of the area, the reorganisation or otherwise of the landscape during the Early Medieval period. It has illustrative value as its presence in the landscape provides a visible mark of a significant moment in the history of the UK. The various sections of the Dyke are Scheduled Monuments of High Sensitivity.	
Section of Offa's Dyke (SM DE194)	1.2km SW of main body of site 200m S of possible cable route			High
Section of Offa's Dyke (SM DE183)	850m NW			High
Section of Offa's Dyke (SM DE182)	700m W			High
Section of Offa's Dyke (SM DE181)	450m W			High
Section of Offa's Dyke (SM DE180)	200m W at closest			High
Section of Offa's Dyke (SM DE139)	200m W			High

Section of Offa's Dyke (SM DE132)	Crossed by potential cable route. 350m SW of main body of Site.			High
Cadwgan Hall Mound (SM DE131)	600m SW of core site, adjacent to potential cable route.	This monument is an earthwork built on a natural hillock, approximately 2.4m high and 42m in diameter. It is adjacent to Offa's Dyke (DE 132 section) and has been variously interpreted as a Prehistoric barrow, a Medieval motte, and an entirely natural feature. There is a World War 2 air-raid shelter cut into the side of the mound.	The significance of the mound is vested in its provision of an example of a Medieval defensive structure, and its association with the later Medieval house of Cadwgan Hall, and the earlier boundary earthwork of Offa's Dyke. It remains formally undated but is a Scheduled Monument of High Sensitivity.	High
Moated site (SM DE193)	950m S	This Medieval moated site is described by the Ordnance Survey as a sub rectangular platform, c. 28m north-south and 24m east-west. Remains of buildings were reported here and depicted on the OS map of 1979. The monument is overgrown with trees, and there is a high-voltage overhead electricity pylon adjacent to it.	The monument's cultural significance derives from its being a well-preserved relic of the medieval landscape. It retains significant archaeological potential, with a strong probability of the presence of intact archaeological deposits and structural evidence that would add greatly to understanding of Medieval settlement and economy. The asset is a Scheduled Monument of High Sensitivity.	High
Bronze Age barrow (SM DE048)	1km S	This monument is a circular mound, approximately 28m in diameter and 1.3m high. It lies in an agricultural field and is assumed to be of Bronze Age date.	Such barrows are significant for the information they contain about beliefs and burial rituals in the Bronze Age and can contain environmental and other archaeological evidence preserved in the original deposits, and in the buried soil	High

			horizon in which the barrow is built. It is a Scheduled Monument of High Sensitivity.	
Bersham Conservation Area and listed buildings within (including Ironworks SM)	Contiguous with the site's southern boundary	Bersham Conservation Area is situated within the wooded part of the upper reaches of the Clywedog Valley. The Conservation Area possess four distinctive character areas: the lane from the west boundary to Mill Farm; the area of the West Ironworks Site; the East Ironworks; and Bunkers Hill and Y Ddol. However, the overall character and appearance of the Conservation Area is largely of a rural settlement that has been heavily influenced by both its industrial past and the nearby Plas Power estate. Built form within the Conservation Area demonstrates a variety of architectural styles and is generally of a high quality, with many listed buildings and structures. The scheduled remains of Wilkinson's Ironworks, in addition to structures relating to historic water management, and workers' cottages, provide an important link to the Area's industrial past. The architectural influence of the Plas Power Estate is also evident in the Area's built form, with the Romanesque-style Church of St Mary (Grade II*, ref. 16553) forming a landmark building within the Conservation Area, and with a number of buildings within the Conservation Area displaying the distinctive 'estate architecture' style that indicates their origins as part of the Plas Power Estate.	The Conservation Area's cultural significance derives from its historic interest as a village shaped by industrial development and estate control. The latter is reflected in the estate architecture which is prevalent in the conservation area architecture. The quality of the architecture combined with the wooded valley setting give the Conservation Area a high degree of aesthetic value. The Conservation Area is considered to be of High Sensitivity.	High
Plas Power Grouping - comprising the Ice	50m to 100m W	A loose group of five estate buildings associated with Plas Power (demolished	The significance of these assets is largely derived from their historic form and fabric,	Medium

House (Grade II, ref. 1739), Stable Block (Grade II, ref. 16452), Bath House (Grade II, ref.16453), Game Larder (Grade II, ref. 1737), and Dairy (Grade II, ref. 1738).		1946-7): With the exception of the stables, the buildings are in a poor state of repair.	and from their historic interest as surviving architectural elements of the Plas Power Estate. They possess historic illustrative value as mid-nineteenth century estate buildings, with the Bath House being a rare example of an architecturally conceived well-house and the Stables remaining largely intact and in their original use. They also possess associative value with both the Plas Power Estate and notable architect John Gibson, and evidential value as they provide evidence of the layout and form of Thomas Lloyd Fitzhugh's remodelling of the Estate. The assets possess some aesthetic value due to their high-quality design and construction. These Grade II Listed Buildings form an asset group of Medium Sensitivity.	
Walls, railings, gates and entrance lodge to Plas Power Park – comprising the Walls to Plas Power Park including Park Cottage (Grade II, ref. 16455), Wall to Plas Power Park SW of Rhosberse Lodge (Grade II, ref. 16456), Rhosberse Lodge at Entrance to West drive at Plas Power (Grade II, ref. 1740), and Railings and Gates to West Entrance Drive at Plas Power (Grade II, ref. 16454)	300m W	Boundary structures and buildings associated with the remodelling of Plas Power in 1848 by the then-owner Thomas Lloyd Fitzhugh, and are all associated with his enclosure of the Parkland around this time too.	The significance of these assets is largely derived from their historic form and fabric, and from their historic interest as surviving architectural elements of the Plas Power Estate. They possess historic illustrative and aesthetic value as examples of estate architecture adopting the Picturesque architectural style, in particular the striking boundary wall. They also possess associative value with the Estate, and share group value with each other and with other surviving elements of Lloyd Fitzhugh's works. They are considered here as a group of assets of Medium Sensitivity.	Medium

Higher Berse Farmhouse (Grade II, ref 16457)	600m E of northern part of site	A fine example of an early-nineteenth century farmhouse retaining much of its original fabric and design. It was built in 1814 on the site of an earlier farmhouse that was purchased and immediately demolished by the Plas Power Estate..	The significance of Higher Berse Farmhouse is as an early-nineteenth century gentry farmhouse retaining a relatively high degree of integrity. The asset possesses historic illustrative value as a substantial farmhouse of some status, typical of a period when many landowners were undertaking agricultural 'improvement'. Its surviving original interior features likely illustrate tastes in décor in this period also. The asset's pleasing design and architectural detailing provides the asset with aesthetic value, and the asset may possess some evidential value as further investigation may reveal more about the previous farmhouse that stood on the site. It is a Grade II Listed Building and of Medium Sensitivity	Medium
Tyn-y-Coed (Grade II, ref. 1562)	200m NW	Tyn-y-Coed is an example of a mid-eighteenth century dwelling house that appears to represent a single phase of building, albeit with some twentieth-century alterations to the exterior. It is constructed of brown brick with a slate roof, coped gables, and multi-pot end stacks. The rear of the building has been rendered and painted. The asset is arranged over three storeys with its primary front (being of three bays with a central entranceway). The asset's fenestration is original, but the windows themselves are modern.	The building's significance derives from its being 'a significant survivor of a mid C18th house in this area, notwithstanding extensive alteration to exterior detail'. It possesses historic illustrative and evidential values as a substantial mid-eighteenth-century farmhouse, demonstrating local design practices and vernacular materials employed at this time. Its materials and architectural detailing also provide the asset with some aesthetic value, notwithstanding the modern alterations that detract somewhat from its appearance. It is a Grade II Listed Building and of Medium Sensitivity	Medium

Future Baseline Conditions

7.51 The site currently comprises agricultural land used primarily for arable purposes. The archaeological assessments undertaken on the site identified potential archaeological features in some parts of the site, as yet undated.

7.52 In terms of the future baseline, it is considered that without the implementation of the Proposed Development, the site would remain in use as agricultural land. The likely evolution of the current archaeological environment would include the unrecorded loss of the archaeological receptors on the site through continued agricultural practices. While climate change might not directly impact on the archaeological resource, it might lead to changes in agricultural regimes which will.

Mitigation Measures Adopted as Part of the Proposed Development

Archaeology

7.53 Potential impacts on the scheduled Offa's Dyke (DE132 & DE194) where its line may be crossed by the proposed grid connection will be avoided either by routing the grid connection along an existing road and hence existing break in the dyke or the use of horizontal directional drilling (HDD). Should the latter option be selected, a geophysical survey will be undertaken to establish the depth of the archaeological features and HDD used to insert the cable at sufficient depth under the Scheduled Monument to prevent any direct or indirect disturbance. There will consequently be no impact on the physical fabric of the scheduled Offa's Dyke.

7.54 Construction phase impacts upon buried archaeology have been reduced through measures embedded in the design of the Proposed Development. As part of the baseline surveys, a geophysical survey was undertaken, which took in land outside the current Site. It identified anomalies thought to represent the remains of a monastic grange, possible barrows and bell pits relating to early coal mining (see **Appendix 7.1**). The areas in which these anomalies were recorded have been excluded from the Site. Consequently, potential impacts upon them have been prevented.Please refer to Chapter 3: Need and Alternatives Considered for further information regarding the evolution of the Proposed Development location and layout.

7.55 An area of upstanding ridge and furrow is located in the western part of the Site. No ground disturbance is proposed here; the design therefore provides for its preservation in situ and prevents any adverse impact.

7.56 No archaeological effects are anticipated at the operational stage and therefore no further mitigation measures would be required in this phase.

7.57 Where possible, historic hedgerows have been maintained within the Indicative Proposed Site Plan (**Figure 2.1**).

Impacts on Settings

7.58 In the original version of this scheme, potential impacts on the settings of designated heritage assets were assessed and discussed with Cadw, the Local Planning Authority, and CPAT. Subsequent changes to the design have much reduced potential impacts on the settings of Scheduled Monuments and Listed Buildings. This has been achieved by pulling the development as a whole back from Offa's Dyke and the solar arrays back the Listed Buildings at Plas Power (1737-9 and 16452-3).

7.59 The grid connection will run underground and will be reinstated to pre-construction conditions.

Consequently, potential operational phase impacts relating to the grid connection have been avoided through design.

7.60 Where deemed necessary, proposals for additional screening planting have been incorporated into the landscape design (please refer to Illustrative Landscape and Ecology Masterplan which is included at **Figure 5.10** of this ES).

Assessment of Construction Effects

7.61 This section identifies and assesses the likely impacts and effects on relevant archaeological and built heritage assets during the construction phase of the Proposed Development. The potential impacts, and the significance of the effects on the assets are characterised in the absence of mitigation measures. Where appropriate, mitigation measures are then set out and residual effects assessed.

Heritage Assets within the Site

Potential Effects

7.62 The assessment of the impact of construction works is based on the knowledge regarding the site's archaeological remains and assumed construction impacts (described below).

7.63 The evaluation work, comprising geophysical surveys and trial trenching, has identified features of limited local interest that are considered to be of negligible sensitivity. These lie in areas that will be occupied by solar arrays and, in the case of the features identified in the northern part of the Site, crossed by an access track. They will therefore be subject to localised disturbance by the driven piles supporting the arrays and disturbance or partial removal by the laying of the access track. This will result in limited disturbance and hence potentially some loss of archaeological data and an adverse impact of, at most, Low magnitude. The features are considered to be of negligible sensitivity and this will equate to an effect of **Negligible** significance. This is not significant in EIA terms.

7.64 Given the inherent limitations of archaeological evaluations, there is potential for hitherto unrecorded archaeology to be present within the Site. However, the results of the geophysical surveys and trial trenching suggest that this potential is low. If present, such remains may be disturbed by the driving of piles for the solar arrays, the stripping of topsoil for access tracks, compounds, transformer bases and similar and the excavation of cable trenches. Such ground disturbance will affect only a very small percentage of the Site; typically piles disturb less than 1% of such developments' area. Consequently, it is considered that the potential for hitherto unrecorded archaeology to be affected is negligible.It is therefore considered that there is negligible potential for impacts to occur in respect of hitherto unrecorded archaeology.The identified historic hedgerows are to be retained where practicable but may suffer minor impacts in the form of partial removals. This would equate to a Medium impact on a receptor of Low Sensitivity, resulting in an effect of **Minor Adverse significance** and therefore not significant in EIA terms.

7.65 The visible ridge and furrow earthworks within the site lie outside areas of ground disturbance and hence will be unaffected.

7.66 As outlined above (paragraph 7.53) potential effects upon the scheduled Offa's Dyke will be prevented through the use of HDD.

Mitigation

7.67 The trial trenching has established that the features present have very limited archaeological value. Consequently, no further archaeological mitigation is proposed in respect of these..

7.68 No mitigation is proposed in respect of historic hedgerows.

Residual Effects

7.69 No mitigation is proposed in respect of construction phase impacts upon archaeological features within the Site. The predicted impact will remain at most of Low magnitude and would represent a residual effect of **Negligible** significance. This is not significant in EIA terms.

7.70 No mitigation is proposed in respect of historic hedgerows. The predicted impact will remain of Medium magnitude, resulting in an adverse effect of **Minor** significance, which is not significant in EIA terms..

Impacts relating to setting

7.71 Construction operations may result in change in the setting of heritage assets as a result of factors such as plant movement, increased traffic, construction compounds and noise. Such change will be temporary, ceasing at the end of the construction phase, and may occur only intermittently or be transitory. As such they are unlikely to be significant. Nevertheless, the potential construction phase impacts relating to setting are assessed in **Table 7.6**. This is informed by the ZTV.

Table 7.6: Construction phase setting effects upon designated heritage assets

Asset	Impact	Magnitude	Sensitivity	Effect
Bersham Ironworks, (SM DE189)	Construction operations visible from the northern part of the Scheduled Monument at short range. Plant will be audible. The affected views do not contribute to the ironworks' significance and plant noise will constitute a very short-term change in its setting that will not affect the cultural significance of this industrial site.	Negligible	High	Negligible (not significant)
Section of Offa's Dyke (SM DE183)	No intervisibility.	No change	High	No effect
Section of Offa's Dyke (SM DE182)	Construction operations potentially glimpsed through trees at a minimum distance of 800m. The affected views do not contribute to the earthworks' significance.	No change	High	No effect
Section of Offa's Dyke (SM DE181)	Construction operations potentially glimpsed through trees at a minimum distance of 30m. The affected views do not contribute to the earthworks' significance. Plant noise will constitute a very short-term slight change in its setting that does not affect cultural significance of this boundary feature.	Negligible	High	Negligible (not significant)

Asset	Impact	Magnitude	Sensitivity	Effect
Section of Offa's Dyke (SM DE180)	Construction operations potentially glimpsed through trees at a minimum distance of 85m. The affected views do not contribute to the earthworks' significance. Plant noise will constitute a very short-term slight change in its setting that does not affect cultural significance of this boundary feature.	Negligible	High	Negligible (not significant)
Section of Offa's Dyke (SM DE139)	Construction operations visible at a minimum distance of 200m. The affected views do not contribute to the earthworks' significance. Plant noise will constitute a very short-term slight change in its setting that does not affect cultural significance of this boundary feature.	Negligible	High	Negligible (not significant)
Section of Offa's Dyke (SM DE132)	No intervisibility with the main site. Cable laying operations may be visible in relatively short-range views. This would result in short-term change in the dyke's setting that would not affect its significance.	Negligible	High	Negligible (not significant)
Section of Offa's Dyke (SM DE194)	No intervisibility with the main site or cable route.	No change	High	No effect
Cadwgan Hall Mound (SM DE131)	No intervisibility with the main site. Cable laying operations may be visible in relatively short-range views. This would result in short term change in the mound's setting that would not affect its significance.	Negligible	High	Negligible (not significant)
Moated site (SM DE193)	No intervisibility.	No change	High	No effect
Bronze Age barrow (SM DE048)	No intervisibility.	No change	High	No effect
Bersham Conservation Area and listed buildings within (including Ironworks SM)	Construction operations in the main site visible from the northern fringes of the Conservation Area at short range. Plant will be audible from this area and potentially elsewhere in the Conservation Area. The affected views do not contribute to the Conservation	Negligible	High	Negligible (not significant)

Asset	Impact	Magnitude	Sensitivity	Effect
	Area's significance and plant noise will constitute a very short-term change in its setting. Cable laying will take place within the Conservation Area, resulting in short term change that will not affect its cultural significance.			
Plas Power Grouping - comprising the Ice House (Grade II, ref. 1739), Stable Block (Grade II, ref. 16452), Bath House (Grade II, ref.16453), Game Larder (Grade II, ref. 1737), and Dairy (Grade II, ref. 1738).	Construction operations visible from the fringes of the group at short range. Plant will be audible from this area. The affected views do not contribute to the group's significance and plant noise will constitute a very short-term change in its setting.	Negligible	Medium	Negligible (not significant)
Walls, railings, gates and entrance lodge to Plas Power Park – comprising the Walls to Plas Power Park including Park Cottage (Grade II, ref. 16455), Wall to Plas Power Park SW of Rhosberse Lodge (Grade II, ref. 16456), Rhosberse Lodge at Entrance to West drive at Plas Power (Grade II, ref. 1740), and Railings and Gates to West Entrance Drive at Plas Power (Grade II, ref. 16454)	Very limited potential for construction operations to be visible, limited to Walls to Plas Power Park including Park Cottage (Grade II, ref. 16455) at a distance of at least 400m. The affected views do not contribute to the Listed Building's significance	No change	Medium	No effect
Higher Berse Farmhouse (Grade II, ref 16457)	Very limited potential for construction operations to be visible at a distance of at least 360m. Construction operations potentially audible. No potential for this to affect cultural significance.	Negligible	Medium	Negligible (not significant)

Asset	Impact	Magnitude	Sensitivity	Effect
Tyn-y-Coed (Grade II, ref. 1562)	Very limited potential for construction operations to be visible at a distance of at least 130m. Construction operations potentially audible. No potential for this to affect cultural significance.	Negligible	Medium	Negligible (not significant)

Mitigation

7.72 No significant construction phase effects relating to the setting of heritage assets are predicted and no mitigation is proposed in respect of the predicted negligible effects.

Further Mitigation

7.73 No mitigation beyond that identified above (paragraph 7.67) is proposed.

Accidents and/or Disasters

7.74 There are no anticipated accidents or disasters which would affect identified archaeological or built heritage assets.

Assessment of Operational Effects

7.75 This section provides an assessment of potential effects that would occur during the operational phase of the Proposed Development. The Proposed Development is fully described in detail in Chapter 2 of this ES. This description makes clear that the Proposed Development is fully reversible at the end of its 'lifespan' (up to 40 years).

Heritage Assets within the Site

7.76 The operational phase of the Proposed Development will not have any direct physical effect on archaeological remains within the site as this will not typically involve any ground disturbance. In the event that ground disturbance is required, for example where repairs are necessary to buried infrastructure, this will be contained within ground disturbed during the construction phase of the Proposed Development. There is therefore no potential for operational effects upon buried archaeology.

7.77 Historic hedgerows will be maintained throughout the operational phase. There is therefore no potential for operational effects upon historic hedgerows.

Settings

7.78 Some operational effects would arise as a result of primarily visual impacts on the settings of the identified above-ground heritage assets, in particular the appearance of solar panels in views from these assets. Other elements, including the BESS and substation will be screened by topography and woodland. These effects would be limited to the 'lifespan' of the solar farm and would be reversible.

Section of Offa's Dyke in Plas Power Park (DE180, NPRN 275785)

7.79 This section of the Dyke is 640m long and runs on a south-east to north-west alignment to the west

of the site. The line of the Dyke is very easy to follow, as the bank is heavily overgrown with trees and shrubs, and so is experienced as a dense hedgerow between two arable fields. There is no pedestrian route alongside or parallel to the Dyke, and it is not clear that there is a bank until climbing over the monument when using the footpath that crosses it at right angles towards its north-western end.

7.80 The setting consists essentially of the two adjoining fields immediately to the west of the site. The monument is not generally visible from the west, where the estate wall blocks any view, but can be seen from the road to the west where it reaches that road. It can be seen from the footpath which crosses the Dyke. Towards the east, the ground slopes downwards and views are obscured by woodland and to some extent enclosed by the hedgerow which forms the western boundary of the site.

7.81 As the western part of the site lies in the wider setting of the monument, Proposed Development within the study site can be considered to have a potential impact on that setting. While the visual nature of the setting will be altered, there will be no alteration to how the monument is experienced, nor any diminution in how it is understood. The solar panels will present a uniform appearance across the field to the east, and will introduce a more static, industrial feel to the setting, but nonetheless the monument will retain its form and function as a field boundary, and so retain the bulk of its significance. The nearest solar panels will be approximately 110m from the monument, and the footpath and the panels, so the monument will still be visible from the current vantage points along the footpath which crosses it.

7.82 Overall, it is clear that the Proposed Development will impact on the significance of the monument to some extent, but it is considered that this will not reach an unacceptable level. The primary significance of the monument will not be affected, and the setting will be altered but not to the extent that the monument cannot be experienced in its current form.

7.83 As a result, it is considered the Proposed Development would have a **Low to Negligible** impact on an asset of High Sensitivity would result in a significance of effect of Minor Adverse at most and therefore not significant in EIA terms.

Section of Offa's Dyke in Plas Power Woods (DE139, NPRN 275766)

7.84 This section of the Dyke runs for c. 550m southwards from the southern end of DE180, through Plas Power Woods to the river Clywedog. The monument lies largely in dense woodland and is not currently easily accessible – it is difficult to experience due to this.

7.85 The significance of the monument is as described in the sections above for Offa's Dyke as a whole, but it does not have the open aspect and accessibility of DE180.

7.86 The setting is contained entirely within Plas Power Wood.

7.87 The western boundary of the site lies within 150m to 200m of the monument, but it is considered that the Proposed Development will not be intervisible with the Dyke at this point due to the density of the woodland screening it from view.

7.88 As a result, it is considered that no impact will arise on the monument from the Proposed Development, and therefore there will be **no effect on its significance**.

Section of Offa's Dyke: Cadwgan Hall section (DE132, NPRN 275760)

7.89 This section runs north-south from the Clywedog river to an east-west stream, and beyond to a disused railway for approximately 1km. DE 132 is experienced as an overgrown field boundary. Its setting is confined to the agricultural fields to east and west, with a more open aspect to the west.

7.90 The dense woodland in the Clywedog valley effectively prevents any intervisibility with the monument, and it cannot be seen from the site.

7.91 As a result of these factors, it is considered that the Proposed Development would have no impact on the setting of the monument, on account of the lack of intervisibility, and therefore **no effect on its significance.**

Sections of Offa's Dyke north of DE180: North section at Coedpoeth (DE181, NPRN 275786); south of River Gwenfro (DE182, DE183, NPRN 303287)

7.92 These sections of Offa's Dyke run northwards away from Plas Power Park, and at an increasing distance (250m to 750m) from the solar arrays. Whilst the ZTV indicates a degree of intervisibility between these sections of Offa's Dyke, particularly that at Coedpoeth (DE181), numerous hedgerows lie between it and the proposed solar arrays, resulting in there being negligible intervisibility. Owing to this and the distance between theses Scheduled Monuments and the proposed solar arrays, it is considered that there would be No Impact on their settings, and so there would be **No Effect on their significance** as a result of the Proposed Development and therefore no significant effects in EIA terms.

Cadwgan Hall Mound (DE131, NPRN 275759)

7.93 The setting of the mound is tightly constrained to the south and east by the farm buildings and other structures of Cadwgan Hall. It is more open to the west and north and includes views towards the site to the north-east. The setting makes some contribution to the significance of the monument, but as the interpretation of the mound remains unproved, the scale of this contribution is difficult to assess.

7.94 The site to the north-east (approximately 1km at nearest) forms no part of the setting of the monument. There is no intervisibility between the monument and the site. It is considered therefore that no impact would arise on its setting, and therefore there would be **no effect on its significance** as a result of the Proposed Development and therefore no significant effects in EIA terms.

Croes-Foel Barrow (DE048, NPRN 307140)

7.95 The setting is enclosed within the field, with relatively limited views outwards, due to intervening vegetation in the form of hedgerows with frequent mature trees. The dense tree growth along the disused railway to the north is the main inhibitor to views northwards towards the site. It effectively masks any such views.

7.96 As a result of this lack of intervisibility, and lack of any associative relationship with the site, it is considered that No Impact would arise on the setting of the barrow form the Proposed Development, and consequently no effect on its significance would arise and therefore **no significant effects** in EIA terms.

Llyntro Moat Rhostyllen (DE 193, NPRN 27460)

7.97 The setting is within the field in which it sits, with relatively limited views outwards, due to intervening vegetation in the form of hedgerows with frequent mature trees. The dense tree growth along the disused railway to the north is the main inhibitor to views northwards towards the site. It effectively masks any such views.

7.98 As a result of this lack of intervisibility, and lack of any associative relationship with the study site, it is considered that no impact would arise on the setting of the moat from the Proposed Development, and consequently **no effect** on its significance would arise and therefore no significant effects in EIA terms.

Bersham Ironworks (DE189, NPRN 34051), Conservation Area and associated Listed Buildings, immediately south of the site.

7.99 The remains of the Bersham Ironworks lie in the Clywedog valley a short distance south of the south-east boundary of the site. It is a Scheduled Monument of High Sensitivity.

7.100 Surviving designated buildings within the ironworks include the octagonal cannon foundry (NPRN 40427, Grade II*, 1586) and adjacent probable fettling shop (Grade II*, 16539), and a boring mill (NPRN 24854) later converted into a corn mill (NPRN 24853, Grade II 16538). Within the Scheduled area are other substantial remains, including lengths of wooden railway and a furnace (NPRN 34053), uncovered through excavations since 1987. Associated are two weirs (NPRNs 34404 and 33629) and the former accounts house (NPRN 26752). Its significance is vested in the survival of these original features and structures, and in the historical importance of the processes developed at Bersham.

7.101 The ironworks was established in about 1715, possibly as early as the 1670s. The works started to produce cast iron goods from the early 1730's. Isaac Wilkinson took over the works in 1753 and for the first time began producing iron cannon. A large steam engine was installed for pumping water around the furnace water wheel, and a number of wagonways to the works were constructed.

7.102 Bersham dramatically increased in size and profitability reaching its peak in about 1795. Decline set in soon afterward with the establishment of Brymbo ironworks nearby. The works were finally sold in 1812.

7.103 The Conservation Area contains other Listed Buildings, including the Church of St Mary (Grade II*, 16553); The White House (Grade II, 16561); Mill House Farmhouse (Grade II, 16540); 2-6 Mill Terrace (Grade II, 16541, 16546, 16547, 16550, 16549); and East Weir on River Clywedog Grade II, 16552). The Conservation and its associated buildings together form an asset of Medium Sensitivity. St Mary's Church is a Grade II* Listed Building of High Sensitivity.

7.104 The setting of the Scheduled Monument is largely enclosed in the wooded valley of the Clywedog river. It is more open to the south, where the road runs, and other village buildings are clustered around the works. On the north side, the valley rises in a shallow cliff, with trees above, which serve to prevent any intervisibility between the site and the ironworks buildings. While the Scheduled Area does extend onto farmland above the ironworks, up to the boundary with the site, this part of the SM has been disturbed by the opencast mining activity, which extracted coal to within a few metres of the top of the cliff and has removed any vestiges of ironworks activity in this area.

7.105 As a result of the lack of intervisibility, and the erasure of any potential archaeological remains of the ironworks in the land above the cliff, it is considered that the Proposed Development would have no impact on the monument or its setting. It will, therefore, have no effect on the significance of the Bersham ironworks Scheduled Monument and therefore no significant effects in EIA terms.

7.106 The same applies to the Listed Buildings within the village of Bersham, and indeed the wider Conservation Area. There is a lack of intervisibility between these assets and the site, as they are shielded from this intervisibility by the topography and the woodland along the Clywedog Valley.

7.107 As a result of the lack of intervisibility between the site, and the Conservation Area and its Listed Buildings, it is considered that the Proposed Development would have **No Impact** on any of these assets or their settings. It will, therefore, have **no effect** on the significance of the Bersham Ironworks, or the Bersham Conservation Area or any of the designated assets within it and therefore no significant effects in EIA terms.

Plas Power Grouping, 50-150m west of the site.

7.108 With the exception of the Stables, these assets are surrounded by the plantation that has enclosed

them since they were constructed alongside the main house in the mid-nineteenth century. As such, their setting is largely constrained within the woodland. The Stables lie just to the north of the plantation, associated with more modern undesignated buildings.

7.109 It is only the Stables which have any intervisibility with the site, and that only a limited part of the site to the east, where panels have been pulled back in this revised scheme to reduce any visual impact. Consequently, it is considered that there will be little appreciable change in the setting of these assets and this will have no impact upon their significance.

7.110 As a result, it is considered that the Proposed Development will have no more than a Negligible impact on the setting of the Plas Power group, and a **Negligible** effect on its significance and therefore no significant effects in EIA terms.

Walls, railings, gates and entrance lodge to Plas Power Park

7.111 The assets are situated along Rhosberse Road, forming the western boundary of the former area of parkland at Plas Power. This setting makes an important contribution to the significance of the assets, as they were originally constructed to enclose this parkland, and were intended to be experienced when passing along Rhosberse Road.

7.112 The western areas of the site have a historical relationship with the assets, forming part of the parkland of Plas Power, and so contribute to its setting and significance. The amended scheme has removed any solar panels close to the wall, and the setting of this group of assets is constrained by the section of Offa's Dyke between the asset group and the site. As a result, there is no intervisibility with the site and the assets along Rhosberse Road. The impact on the wider setting will be confined to the change of use of the parkland to a solar farm, rather than visual impacts on the assets themselves.

7.113 It is considered therefore that the Proposed Development will have no more than a Negligible impact on the setting of this asset group, and a **Negligible** effect on its significance and therefore no significant effects in EIA terms.

Higher Berse Farmhouse (Grade II, ref. 16457)

7.114 The immediate setting of Higher Berse Farmhouse comprises the sizeable garden plot in which it is situated and the former farmyard to the east. The wider setting of the asset can be considered to include the surrounding open fields, with the northern part of the site beyond the immediate fields to the west. This agricultural land helps to place the asset in its historic rural context, making a positive contribution to its historic illustrative value and significance. The asset has no intervisibility with the other parts of the site south of the A525.

7.115 The Proposed Development would change the appearance of the fields it occupies, which will have an impact on part of the wider rural setting of Higher Berse Farmhouse. However, intervisibility will be extremely limited owing to the nearest solar arrays being over 350m away and beyond numerous hedges. This is considered to be no more than a Negligible impact, on an asset of Medium Sensitivity, resulting in a **Negligible** effect on the significance of the asset and therefore no significant effects in EIA terms.

Tyn-y-Coed (Grade II, ref. 1562)

7.116 Tyn-y-Coed is an example of a mid-eighteenth-century dwelling house that appears to represent a single phase of building, albeit with some twentieth-century alterations to the exterior. It is a designated heritage asset of Medium Sensitivity.

7.117 The immediate setting of the asset is defined to the north by a collection of agricultural outbuildings

arranged around a former yard. To the south, east and west, the asset's immediate setting comprises a well-treed garden plot and areas of hardstanding surrounded by a random rubblestone wall approximately six feet in height.

7.118 The wider rural setting includes the northern part of the site, but intervisibility is extremely limited owing to intervening vegetation, including the trees surrounding the house, and as consequently the wider landscape makes a minor contribution to the significance of the asset.

7.119 There are potential glimpsed views between the upper floors of the house and the northern part of the site. These views do not contribute to the cultural significance of the building, which relates to its architectural interest and hence fabric. The rural character of the building's surroundings will, however, be very slightly eroded. Given that the nearest solar arrays will be over 200m from the farmhouse and that visibility from its immediate surroundings will be very limited by the surrounding trees it is considered that this would result in an impact of negligible magnitude. The farmhouse is of Medium Sensitivity. It is concluded that this would represent an effect of **Negligible** significance. This is not significant in EIA terms.

Further Mitigation

7.120 As discussed above, mitigation measures in respect of construction phase impacts are embedded in the design, in the form of avoidance of areas of greatest archaeological potential and the use of HDD where the cable route crosses the scheduled Offa's Dyke. Mitigation beyond this will take the form of offsetting the physical loss of archaeological remains through an appropriate programme of archaeological works that will allow for hitherto unrecorded archaeology to be identified and appropriately recorded. The scope of this work set out in a Written Scheme of Investigation (WSI).

7.121 No mitigation of operational phase impacts beyond that embedded in the design is proposed or considered to be required. The revised scheme layout and the proposed landscaping works will act to soften the appearance of the Proposed Development within the extended settings of the affected heritage receptors.

Assessment of Decommissioning Effects

7.122 Ground disturbance associated with decommissioning phase will be restricted to those areas disturbed during the construction phase. It is therefore considered that there is no potential for decommissioning to affect the physical fabric of any heritage assets.

7.123 Decommissioning effects relating to setting would be equivalent to those detailed in the construction phase assessment. No significant effects are therefore predicted.

Future Monitoring

7.124 Monitoring is not considered to be required.

Accidents/Disasters

7.125 There are no anticipated accidents or disasters which would affect archaeological or built heritage assets.

Potential Changes to the Assessment as a Result of Climate Change

7.126 Climate change would not cause any future changes of baseline conditions that would fundamentally change the assessment set out above. Variances in planting due to climate change may affect future

intervisibility, but due to the distance between the site and the surrounding heritage receptors, and the nature of the setting of these heritage receptors, these changes would not be expected to fundamentally alter the assessment itself or the identified significance of effects.

Assessment of Cumulative Effects

7.127 The assessment of cumulative effects considers the impacts and significance of effects associated with the Proposed Development for the historic environment alongside other relevant developments which are consented or for which planning permissions are currently being sought. Cumulative schemes are identified in **Table 7.7** and shown on **Figure JPW1473-DNS-007**.

Table 7.7: Cumulative Developments considered in the Cultural Heritage Assessment

Ref	Cumulative Schemes	Distance from the site	Potential effects
Permission Granted			
1	**Legacy Substation** Legacy National Grid Station, Bronwylfa Road, Talwrn, Wrexham Installation and operation of battery storage facility and ancillary development at the Legacy National Grid Substation to provide the proposed point of connection for the Plas Power Solar Farm. **P/2023/0175** Granted 24/07/23	110 - 260m To the cable route (dependent on cable route option)	No potential for cumulative physical effects owing to distance between schemes. No potential for cumulative effects relating to setting owing to lack of visibility in combination from designated heritage assets.
Pending Determination			
2	**Land South of Berse Road** Land South of Berse Road, Caego, Wrexham Residential development of 47 dwellings with associated access, landscape and open space. **P/2023/0221**	540m	No potential for cumulative physical effects owing to distance between schemes. No potential for cumulative effects relating to setting owing to lack of visibility in combination from designated heritage assets.
Pre-Application			
3	**Bersham Energy Plant** A 30 MW energy plant and reclamation scheme currently at the pre-application stage. **DNS/3237973**	110 - 260m To the cable route (dependent on cable route option)	No potential for cumulative physical effects owing to distance between schemes. No potential for cumulative effects relating to setting owing to lack of visibility in combination from designated heritage assets.
Pre-Application Consultation			
4	**Lower Berse Farm** Lower Berse Farm, Ruthin Road (A525), Wrexham Proposed development for a new community-led neighbourhood, delivering in the region of 1,500 homes on a site allocated for housing in the WCBC emerging LDP.	50m	No potential for cumulative physical effects owing to distance between schemes. No potential for cumulative effects relating to setting owing to lack of visibility in combination from designated heritage assets.
5	**Land South of Bersham Road** Legacy National Grid Substation, Bronwylfa Road, Talwrn, Wrexham Currently in public consultation for a proposed Energy Storage System to be	**0-190m** To the cable route (dependant on cable route option)	No potential for cumulative physical effects owing to distance between schemes. No potential for cumulative effects relating to setting owing to lack of visibility in combination from designated heritage assets.

	connected to the existing legacy substation.

7.128 It is considered that there is no potential for significant cumulative effects to arise at any phase of the Proposed Development's lifespan.

Inter-relationships

7.129 There is an inter-relationship between the Cultural Heritage chapter and the Landscape and Visual Impact chapter of this ES. The design of the Proposed Development includes measures to reduce visibility from the surrounding landscape such as the placement of the solar arrays and landscape planting. This has consequently reduced the potential for visual change in the setting of heritage assets in the surrounding landscape.

7.130 There are no inter-relationships with other chapters; given the nature of the archaeological resource and the development, there is no potential for effects to arise as a result of factors such as changes in hydrology or soil chemistry.

Summary of Effects

7.131 Construction activities would result in an impact of Low magnitude upon the archaeological features recorded within the Site. Based on the results of the trial trenching these are considered to be of very limited archaeological interests and therefore of negligible sensitivity. The level of disturbance and consequent loss of archaeological data would be slight, resulting in an impact of Low magnitude. This is considered to represent an effect of Negligible significance. Given the results of the geophysical surveys and trial trenching and the very small proportion of the Site that will be disturbed during construction, it is considered that there is negligible potential for hitherto unrecorded archaeology to be affected.

7.132 Removal of small sections of hedgerows may be necessary during construction. The hedgerows meet the criteria for important historic hedgerows under the Hedgerow Regulations. They are considered to be of local importance and low sensitivity. The loss of small sections would result in an effect of minor significance.

7.133 The operational phase of the Proposed Development will not have any direct physical effect on archaeological remains within the site as it has been assumed that the construction phase of the Proposed Development will have disturbed any remains which may be present as a result of excavation, earthworks and other below ground construction activities.

7.134 The Proposed Development will potentially affect the settings of fifteen heritage receptors through changes to their extended settings. For the identified heritage receptors, no effects greater than of Minor Adverse significance were identified.

7.135 The construction phase of the Proposed Development will result in an introduction of plant to the site, an increase in activity on the site as a result of construction operations, and potential increase in vehicular activity on the routes leading to the site. These changes would result in a short term, temporary, negligible magnitude of impact. This would give rise to a short term, temporary, Negligible/Minor significance of effect.

7.136 The operational phase of the Proposed Development would cause a change within the settings of the above heritage receptors. The change would however be very slight owing to the limited intervisibility, a product of the screening provided by woodland, hedgerows, topography and the built form, which will be further augmented through landscape planting. In addition, this change is fully reversible at the

end of its ‘lifespan’ (up to 40 years).

7.137 No potential cumulative effects have been identified. The cumulative schemes are not adjacent to undisturbed areas of the Site. Consequently, there is no potential for cumulative construction effects in respect of the physical fabric of assets. There is negligible potential for the cumulative schemes to be seen in combination or succession with the Proposed Development in the setting of designated heritage assets. As a result of this, there is no potential for cumulative operational effects relating to setting.

7.138 No inter-related effects have been identified.

7.139 Due to the nature of the impacts and significance of effect in the operational phase described above, further mitigation measures are not considered likely to be required in terms of heritage.

Table 7.8: Summary of Likely Environmental Effects on Cultural Heritage

Receptor	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact	Significance of effect	Significant / Not significant	Notes
Construction phase							
Features identified in geophysical survey and trial trenching	Negligible (Local)	Localised disturbance by piles supporting arrays and laying of northern access track.	Long term (permanent)	Low (Direct)	Negligible	Not significant	
Historic Hedgerows	Low (Local)	Existing openings to be widened	Long term (permanent)	Medium (Direct)	Minor	Not significant	
Section of Offa's Dyke (SM DE183)	High	No impact	N/a	No change	No effect	Not significant	
Section of Offa's Dyke (SM DE182)	High	No impact	N/a	No change	No effect	Not significant	
Section of Offa's Dyke (SM DE181)	High	Construction operations potentially visible filtered through trees and audible.	Short-term (temporary)	Negligible	Negligible	Not significant	
Section of Offa's Dyke (SM DE180)	High	Possible noise and dust, alteration of minor element of setting	Short-term (temporary)	Negligible	Negligible	Not significant	
Section of Offa's Dyke (SM DE139)	High	Construction operations potentially visible filtered through trees and audible.	Short-term (temporary)	Negligible	Negligible	Not significant	
Section of Offa's Dyke (SM DE132)	High	Cable laying operations may be visible at relatively short distances from parts of the Scheduled	Short-term (temporary)	Negligible	Negligible	Not significant	

Receptor	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact	Significance of effect	Significant / Not significant	Notes
		Monument.					
Cadwgan Hall Mound (SM DE131)	High	Cable laying operations may be visible at relatively short distances from parts of the Scheduled Monument.	Short-term (temporary)	Negligible	Negligible	Not significant	
Moated site (SM DE193)	High	No impact	N/a	No change	No effect	Not significant	
Bronze Age barrow (SM DE048)	High	No impact	N/a	No change	No effect	Not significant	
Bersham Ironworks (SM DE189), Conservation Area and listed buildings within	High	Possible noise and dust, alteration of minor element of setting	Short-term (temporary)	Negligible	Negligible	Not significant	
Plas Power Grouping - comprising the Ice House (Grade II, ref. 1793), Stable Block (Grade II, ref. 16452), Bath House (Grade II, ref.16453), Game Larder (Grade II, ref. 1737), and Dairy (Grade II, ref. 1738).	Medium	Possible noise and dust, alteration of minor element of setting	Short-term (temporary)N/a	Negligible	Negligible	Not significant	
Walls, railings, gates and entrance lodge to Plas Power Park – comprising the Walls to Plas Power Park including Park Cottage (Grade II, ref. 16455), Wall to Plas Power Park SW of Rhosberse Lodge (Grade II, ref. 16456), Rhosberse Lodge at Entrance to West drive at Plas Power (Grade II, ref. 1740), and Railings and Gates to West Entrance Drive at Plas Power (Grade II, ref. 16454)	Medium	No impact	N/a	No change	No effect	Not significant	

Receptor	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact	Significance of effect	Significant / Not significant	Notes
Higher Berse Farmhouse (Grade II, ref 16457)	Medium	Construction operations potentially visible and audible.	Short-term (temporary)N/a	Negligible	Negligible	Not significant	
Tyn-y-Coed (Grade II, ref. 1562)	Medium	Construction operations potentially visible, filtered through trees, and audible.	Short-term (temporary)N/a	Negligible	Negligible	Not significant	
Operational phase							
Ridge and furrow recorded in one small area of the Site, of possible Medieval or Post-Medieval date	Low (Local)	No impact	N/a	None	No effect	Not significant	
Features identified in geophysical survey, undated possible archaeology	Low (Local)	No impact	N/a	None	No effect	Not significant	
Historic Hedgerows	Low (Local)	No impact	N/a	None	No effect	Not significant	
Section of Offa's Dyke (SM DE180)	High	Alteration of minor element of setting	Long Term	Low to Negligible	Minor Adverse	Not significant	
Section of Offa's Dyke (SM DE182)	High	No impact	N/a	None	No effect	Not significant	
Section of Offa's Dyke (SM DE181)	High	No impact	N/a	None	No effect	Not significant	
Section of Offa's Dyke (SM DE183)	High	No impact	N/a	None	No effect	Not significant	
Section of Offa's Dyke (SM DE139)	High	No impact	N/a	None	No effect	Not significant	
Section of Offa's Dyke (SM DE132)	High	No impact	N/a	None	No effect	Not significant	
Cadwgan Hall Mound (SM DE131)	High	No impact	N/a	None	No effect	Not significant	
Moated site (SM DE193)	High	No impact	N/a	None	No effect	Not significant	
Bronze Age barrow (SM DE048)	High	No impact	N/a	None	No effect	Not significant	

Receptor	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact	Significance of effect	Significant / Not significant	Notes
Bersham Ironworks (SM DE189), Conservation Area and listed buildings within	High to Medium	No impact	N/a	None	No effect	Not significant	
Plas Power Grouping - comprising the Ice House (Grade II, ref. 1793), Stable Block (Grade II, ref. 16452), Bath House (Grade II, ref.16453), Game Larder (Grade II, ref. 1737), and Dairy (Grade II, ref. 1738).	Medium	Alteration of minor element of setting	Long term	Negligible	Negligible	Not significant	
Walls, railings, gates and entrance lodge to Plas Power Park – comprising the Walls to Plas Power Park including Park Cottage (Grade II, ref. 16455), Wall to Plas Power Park SW of Rhosberse Lodge (Grade II, ref. 16456), Rhosberse Lodge at Entrance to West drive at Plas Power (Grade II, ref. 1740), and Railings and Gates to West Entrance Drive at Plas Power (Grade II, ref. 16454)	Medium	Alteration of minor element of setting	Long term	Negligible	Negligible	Not significant	
Higher Berse Farmhouse (Grade II, ref 16457)	Medium	Alteration of minor element of setting	Long term	Negligible	Negligible	Not significant	
Tyn-y-Coed (Grade II, ref. 1562)	Medium	Alteration of minor element of setting	Long term	Negligible	Negligible	Not significant	
Decommisioning phase							
Section of Offa's Dyke (SM DE181)	High	Decommissioning operations potentially visible filtered through trees and audible.	Short-term (temporary)	Negligible	Negligible	Not significant	
Section of Offa's Dyke (SM DE180)	High	Decommissioning operations potentially audible	Short-term (temporary)	Negligible	Negligible	Not significant	

Receptor	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact	Significance of effect	Significant / Not significant	Notes
Section of Offa's Dyke (SM DE139)	High	Decommissioning operations potentially visible filtered through trees and audible.	Short-term (temporary)	Negligible	Negligible	Not significant	
Bersham Ironworks (SM DE189), Conservation Area and listed buildings within	High	Decommissioning operations potentially audible	Short-term (temporary)	Negligible	Negligible	Not significant	
Plas Power Grouping - comprising the Ice House (Grade II, ref. 1793), Stable Block (Grade II, ref. 16452), Bath House (Grade II, ref.16453), Game Larder (Grade II, ref. 1737), and Dairy (Grade II, ref. 1738).	Medium	Decommissioning operations potentially visible and audible	Short-term (temporary)	Negligible	Negligible	Not significant	
Higher Berse Farmhouse (Grade II, ref 16457)	Medium	Decommissioning operations potentially visible and audible.	Short-term (temporary)	Negligible	Negligible	Not significant	
Tyn-y-Coed (Grade II, ref. 1562)	Medium	Decommissioning operations potentially visible, filtered through trees, and audible.	Short-term (temporary)	Negligible	Negligible	Not significant	
Cumulative Effects							
No potential cumulative effects identified							

References

Ancient Monuments and Archaeological Areas Act 1979, (amended by the National Heritage Act 1983 & 2002, updated in April 2014)

Chartered Institute for Archaeologists (2021) Code of conduct: professional ethics in archaeology

Chartered Institute for Archaeologists, Standard & Guidance for historic environment desk based assessment 2014, updated 2020.

Department for Digital, Culture, Media & Sport, 2013, Scheduled Monuments & nationally important but non-scheduled monuments

Cadw (2011) Conservation Principles, Policies and Guidance for the Sustainable Management of the Historic Environment in Wales. Cadw, Cardiff.

Cadw (2017) Setting of Historic Assets in Wales

CCW/Cadw (2007) Guide to Good Practice on Using the Register of Landscapes of Historic Interest in Wales in the Planning and Development Process, (Revised Edition 2007). Countryside Council for Wales/Cadw, Cardiff.

DCMS, 2010. Scheduled Monuments. Identifying, protecting, conserving and investigating nationally important archaeological sites under the Ancient Monuments and Archaeological Areas Act 1979 March 2010

8 HYDROLOGY AND HYDROGEOLOGY

Introduction

8.1 This chapter reports on the assessment of the effects of the Proposed Development with regards to hydrology and flood risk. This assessment focuses on the likely significant effects of the Proposed Development on local flood risk and effects on water resources, including water quality and flow regimes.

8.2 This chapter describes the assessment methodology; the baseline conditions currently existing at the site and in the surrounding area; the mitigation measures implemented as part of the Proposed Development to prevent, reduce or offset any significant adverse effects; and assesses the likely significant effects on the water environment after these measures have been employed. The need for any further mitigation or monitoring requirements is identified.

8.3 This chapter should be read in conjunction with the Flood Consequence Assessment (FCA) and Conceptual Drainage Strategy (see **Appendix 8.1**).

Assessment Methodology

8.4 This Chapter presents the assessment of likely significant effects of the Proposed Development upon the water environment from the construction, operation and decommissioning stages.

8.5 As described in Chapter 2: Proposed Development Description, the BESS is an integral part of the Proposed Development and has therefore been assessed as such within this ES chapter. The indicative BESS layout is shown on **Figure 2.14** – Indicative BESS Layout (Drawing no: BESS_LYT) and its components are set out in **Table 2.1** of Chapter 2: Proposed Development Description. Construction of the BESS will take approximately 6-9 months which will be independent of the overall construction programme and will be constructed at a later date. As detailed in Chapter 2, there is potential that development of the BESS in this location may not materialise and therefore the Proposed Development design has built in flexibility to place solar panels in this location instead.

8.6 The assessment contained within this chapter has assessed the Proposed Development in the context of the BESS being included as part of the design. In the scenario that the BESS is not built out and this land is used for additional solar panels instead, the effects on flood risk and water quality would be less than those currently presented in this chapter for construction, operation and decommissioning. This is as solar panels are raised above the ground whereas the BESS create impermeable hardstanding. As a result, this assessment currently presents a worst-case scenario and therefore allows the flexibility for either option to be brought forward in the future.

8.7 There are no specific EIA guidelines in relation to assessing the effect of solar and energy storage facilities on water resources, and flood risk. The assessment methodology, therefore, is adapted from the guidance provided in the Design Manual for Roads and Bridges (DMRB) LA104 (Environmental Assessment and Monitoring) and LA113 (Road Drainage and the Water Environment). This guidance provides the robust methodology for infrastructure developments.

Relevant Guidance

8.8 Legislation relevant to the Proposed Development includes:

- Technical Advice Note 15: Development and Flood Risk (2004)

8.9 It is noted that an updated/new TAN 15 and Flood Map for Planning were prepared in 2021; However, the new documents have been temporarily suspended and were subject to further consultation in April 2023.

Planning Policy Context

National Planning Policy

8.10 Relevant national policy is set out within Section 2 of **Appendix 8.1** and includes policy set out within the following documents:

- PPW, Edition 12 (Wales Government, 2024);
- The National Strategy for Flood and Coastal Erosion Risk Management in Wales (Wales Government, 2020);
- Sustainable Drainage System Standards for Wales (Wales Government, 2018);
- Water Framework Directive (WFD) (Directive 2000/60/EC European Parliament 2000)

Local Planning Policy

8.11 Relevant local policy is set out within Section 2 of **Appendix 8.1**. Current local planning policy is set out in:

- Wrexham Local Development Plan 2013 – 2028 (Adopted December 2023).

8.12 The WFD is implemented via River Basin Management Plans, which will be produced for each river basin district every six years. The River Basin Management that the Proposed Development sits in is the Dee catchment.

Relevant Guidance

8.13 This chapter has been produced in accordance with the principles outlined in the following key guidance documents:

- Control of Water Pollution from Construction Sites – Guidance for Consultants and Contractors CIRIA (C532; 2001)
- CIRIA - SuDS Manual (C753; 2015a)
- CIRIA (C741; 2015b) Environmental good practice on site guide
- DMRB, LA104 – Environmental assessment and monitoring
- DMRB LA 113 - Road Drainage and the Water Environment

8.14 The design and construction of the Proposed Development would also adhere to the relevant regulatory and industry practice guidance, including, but not limited to:

- Guidance for Pollution Prevention (GPP) 1: A general guide to preventing pollution (NRW et al 2020);
- GPP 2: Above ground oil storage tanks (NRW et al 2017a);
- GPP 4: Treatment and disposal where there is no connection to the public foul sewer (NRW et al 2017b);
- GPP 5: Works and maintenance in or near water (NRW et al 2018a);

- GPP 8: Safe storage and disposal of used oils (NRW et al 2017c);
- GPP 20: Dewatering of underground Ducts and Chambers (NRW et al 2018b);
- GPP 21: Pollution incident response Plans (NRW et al 2017d);
- GPP 22: Dealing with spills (NRW et al 2018c); and,
- GPP 26: Safe storage of drums and Intermediate Bulk Containers (IBCs) (NRW et al 2018d).

8.15 Working at Construction and Demolition Sites: Pollution Prevention Guidance (PPG) 6 Pollution Prevention Guidelines (NRW et al 2012) was withdrawn in December 2015. However, it still provides useful best practice guidance to inform this assessment.

Study Area

8.16 The site area has been taken as the site boundary, with a 1km buffer considered for the solar and BESS site.

8.17 The 1km buffer is considered appropriate for data collection taking into account the nature of the development and likely zone of influence on hydrological receptors. Given the landscape surrounding local land use activities, it would be difficult to ascertain the exact source of any impacts on water quality beyond 1km. Previously a 250m buffer was agreed as part of the ES scoping report but, this has since been increased given the potential inclusion of BESS.

8.18 A 250m buffer has been applied to the cable route. This is considered appropriate due to the nature of the development, with no permanent changes to terrain.

8.19 A Figure showing the extent of the buffer area is shown in **Figure 8.1**.

Baseline Methodology

8.20 The baseline conditions at the site have been established through a review of the literature and data from publicly available sources, including NRW, British Geological Survey (BGS) and WCBC.

8.21 An initial desk-based review of literature and data sources to support this chapter has highlighted the following sources of baseline data which provide coverage of the Proposed Development area:

- Ordnance Survey (OS) Mapping (Ordnance Survey 2023);
- BGS Geology of Britain Viewer: 1:50,000 Geological Mapping (British Geological Society 2023);
- NRW Flood Risk Map Viewer (NRW 2023);
- DataMap Wales A Geo-portal for Wales (https://datamap.gov.wales/maps/new#/);
- WCBC website (https://www.wrexham.gov.uk/residents);
- WCBC Local Development Plan 2 (2013 to 2028);
- WCBC Preliminary Flood Risk Assessment (2011); and
- WCBC Local Flood Risk Management Strategy (2013).

8.22 In addition to the above data sources, site-specific hydrological data has been obtained via consultation with the NRW, Lead Local Flood Authority, and site reconnaissance.

Consultation

8.23 Formal consultation was undertaken during the course of this assessment. **Table 8.1** sets out consultation responses received in relation to hydrology and flood risk.

Table 8.1: Consultation Responses Relevant to this Chapter

Date	Consultee and Issues Raised	How / Where Addressed
19th July 2023	(NRW scoping response (ref CAS-220315-Y8T1):	
	Flood map for Planning should be used, irrespective of the status of the new TAN15	Flood map for Planning mapping has been used within FCA. This informs the assessment of the fluvial risk.
	The FCA will need to assess flood risk from all sources, including the Afon Clywedog and its tributaries	Site specific FCA has been prepared and is presented within (**Appendix 8.1**). This references the flood risk from all sources including the Afon Clywedog and its tributaries.
	NRW requested that the Proposed Development demonstrate the following: • All solar panels are 300mm above the 1% Annual Exceedance Probability (AEP) + CC event, • Water sensitive infrastructure is 30mm above the 1% AEP + climate change event, including a blockage of any relevant culvert/bridge structures; • Flood risk to site access/egress be assessed, including a blockage of any relevant culvert/bridge structures; • The proposal does not have an adverse impact on flood risk elsewhere, in up to the 0.1% AEP event including a blockage of any relevant culvert/bridge structures. • If no ground raising/reprofiling within the flood outline is proposed then this will need to be outlined clearly in the FCA. • Any cable routes or tracks within the DAM/FMfP will need further consideration to ensure that there is no ground raising or infrastructure which could impact on flood flow route. • Any crossings of the Clywedog (main river) will require a Flood Risk Activity Permit (FRAP) and any access track crossings will require a FRAP and should be clear span crossings, not culverts	No solar panels or water sensitive infrastructure present in a fluvial flood risk area, therefore, no detailed fluvial modelling has been undertaken for blockage scenarios. By nature of the fact the development areas are located outside of any identified risk in the present-day fluvial mapping, they are consequently not subject to a review of climate change data. No flood risk has been identified at site access/egress locations; therefore, blockage scenarios have not been run. This is as its not anticipated to pose a risk. Reprofiling of the potential BESS area may occur because of development. The exact topography of which is yet to be confirmed. Cable routes cross a river and associated flood zone. The risk has been discussed within the report, and it is anticipated that due to digging beneath the river there will be no adverse impact. No access tracks are proposed across main rivers or ordinary watercourses. As such it is not anticipated a FRAP or Land Drainage Consent be required. Solar Arrays are designed to avoid surface water sheeting/pooling/erosion, with water designed to drip off the arrays at multiple points onto vegetated ground below. In addition, there is significant space between rows (typically around 2.5m) to act as natural filter strips SuDS with vegetated ground that slows the movement of surface water. The vegetation will be managed organically and will either be mowed or used for light grazing and will bring multifunctional benefits, including the

		cessation of arable farming and green infrastructure enhancement. In addition, no solar panels are proposed within significant surface water risk areas. Solar panels will be raised at least 800mm above the ground level. Ancillary infrastructure will be placed on a 300mm gravel subbase to ensure a betterment to existing runoff conditions. Further details are included in the Site specific FCA which is presented within (**Appendix 8.1**).
	Flood risk from surface water and small watercourses should be addressed within FCA in consultation with WCBC	Flood risk from surface water and small watercourses has been addressed within the FCA in consultation from WCBC (**Appendix 8.1**).
	DNS: EIA Scoping Direction	
2nd December 2020	The SR states at paragraph 4.7 that the Site comprises Glacial Superficial deposits and gravel overlying bedrock strata of the Pennine Lower and Middle Coal Measures. The SR also states that the shallow coal seams has resulted in the use of much of the Site, particularly to the east and south. The SR does not contain a figure showing the extent of the historical opencast workings compared to the Proposed Development. However, it is stated that the restoration works comprised backfill of excavated areas to approximately 10 to 13 m depth. The SR contains limited information on the geology of the Site and the hydrological connectivity of the opencast restored areas and existing watercourses. Looking at the topography, it is clear the majority of the Site drains into the River Clywedog and subsequently into the River Dee, which is designated as a Special Area of Conservation and a Site of Special Scientific Interest. Due to the limited information available at this stage, it is not possible to discount any significant hydrological impact arising from the development, even if the proposed works will involve limited excavations. The LPA response confirms that the restored open cast mine has the potential to cause residual contamination. Additionally, NRW advise that there is potential to cause pollution during construction. Therefore, a hydrological assessment should be included in the ES, hydrogeological conceptual site model and pollution prevention plan as part of the mitigation, considering both construction and decommissioning. The findings of the assessment should also inform the ecological chapter. The assessment should also investigate whether the presence of a vast area of solar panels may have an impact on the water balance on Site. It has been noted that in some cases, solar panels can generate a localised increase in the water run-off.	The information on bedrock presented in the Scoping Report has been superseded by the change in site areas. A more accurate description is presented in the 2023 DTS and PRA report. The superficial deposits remain the same i.e. combination of Glacial Till (Secondary Undifferentiated) across the majority and Glaciofluvial Deposits (Secondary A) in the east and north-east. The area added to the north of the A525 has strata of the Cefn Rock Sandstone (Secondary A) present sub-drift across the western half. The DTS (**Appendix 4.7**) provides an assessment of potential sources of contamination at the site, associated with historical and current land uses both on site and in the surrounding area and a review of the environmental setting to assess the sensitivity of the surrounding area to contamination/pollution. An outline Conceptual Site Model (CSM) is also included in the DTS which details how any contamination may impact the identified receptors via pollutant linkages. Pollution prevention measures are detailed in the oCEMP (**Appendix 2.2**). Discussion of the impact of solar panels to be installed on the site on the existing run-off regime is included within the FCA (**Appendix 8.1**).
4 April 2024	**Natural Resources Wales – Flood Risk**	It is welcome that NRW has no objection to the development proposal

	Our Flood Risk Map confirms the majority of the site to lie within Zone A, with a small proportion within Zone C2 of the Development Advice Map (DAM) contained in Technical Advice Note (TAN) 15: Development and Flood Risk (2004). The Flood Map for Planning also identifies a proportion of the application site to be at risk of flooding and falls into Flood Zone 2/3 Rivers. The development proposal is for the construction of a solar farm and associated infrastructure. The following comments are based on the proposal being classified as 'less vulnerable' development in accordance with Figure 2 of TAN15. We have reviewed the Appendix 8.1 FCA and Conceptual Drainage Strategy (rpsgroup, February 2024, HLEF 85062). The FCA has reasonably and proportionately addressed flood risk from all sources. We agree with the findings, primarily that there is no built development within Flood Map for Planning zones 2 or 3 other than cable routing. The FCA shows that the risks and consequences could be managed to an acceptable level, we would therefore have no objection to the development proposal on flood risk grounds. Please Note: The River Gwenfro is not a main river as indicated in the FCA and therefore not the responsibility of NRW in terms of legislative requirements.	on flood risk grounds. The River Gwenfro was erroneously referred to as a main river in the FCA when it is in fact not a main river and therefore not the responsibility of NRW in terms of legislative requirements. The FCA has been corrected.
4 April 2024	**NRW – Risk of Pollution during Operation** The ES and supporting information has not recognised the potential pollution/contamination risks that could arise from solar farm infrastructure that could fail, including from fire risk and chemical leakage to the subsurface. Such risks could be further heightened by the instigation of preferential shallow flow pathways arising from the cable trenches that will be required across the site. NRW advise that this should be considered in a qualitative risk assessment through a conceptual site model.	The DTS (**Appendix 4.6**) identifies that the main groundwater receptor to be the underlying Pennine Lower Coal Measures bedrock aquifer designated as a low vulnerability Secondary A Aquifer. The low vulnerability setting, absence of source protection zones and abstractions in the vicinity of the site would indicate a low sensitivity groundwater setting. Much of the site is overlain by Glacial Till which is approximately 6m in thickness. This deposit is a low vulnerability Secondary Undifferentiated Aquifer of minor value and in addition to forming a protective layer over the Secondary A Aquifer is unlikely to breached by any cable trench excavations and would, from a mainly cohesive composition, retard lateral/vertical migration of any liquid contaminants. The PRA (**Appendix 4.6**) includes a Conceptual Site Model (CSM) which assessed potential contamination from historical of existing activities only and does not consider potential pollution which could be caused as a result of the operation of the Proposed Development. To assess the potential impacts of pollution caused as a result of the operation of the Proposed Development, this Chapter has been updated to confirm the proposed conceptual drainage strategy which will

	be implemented to prevent uncontrolled runoff of contaminated water.

Assessment Criteria and Assessment of Significance

8.24 The approach to determining the significance of effects is a two-stage process that involves defining the sensitivity of the receptors and the magnitude of the impacts on those receptors. This section describes the criteria applied in this chapter to assign values to the sensitivity of receptors and the magnitude of potential impacts. The terms used to define sensitivity and magnitude are based on recognised EIA methodology (DMRB LA104 and LA113).

8.25 In addition, the chapter has been produced in conjunction with a Flood Consequence Assessment and Sustainable Drainage Strategy. Appropriate mitigation in line with this has been included in line with National Planning and Local Planning Policy. Mitigation has been incorporated in to the relevant sections of this chapter.

Receptor Sensitivity/Value

8.26 The following terms have been used to describe receptor sensitivity, detailed in **Table 8.2**.

Table 8.2*:* Definitions of Sensitivity or Value Used within this Assessment

Sensitivity	Typical Descriptors
Very High	Receptor with little to no capacity to accommodate change, is high value or critical importance to the local, regional or national economy. Receptor is highly vulnerable to impacts that may arise from the development and recoverability is long term or not possible. **Surface Water**: WFD current overall status of high. The surface water body supports sensitive aquatic ecological receptors and is extensively used for public water supply and large-scale agricultural use. **Groundwater**: Groundwater body supports public and/or large-scale industrial water supply and is a very high productivity aquifer. **Flood Risk**: Land is within a high-risk flood zone or nationally significant infrastructure is present which is protected from flooding by natural floodplain storage.
High	Receptor with a low capacity to accommodate change, is of moderate value with reasonable contribution to the local, regional or national economy. Receptor is generally vulnerable to impacts that may arise from the development and recoverability is flow and/or costly. **Surface Water**: WFD current overall status of good. Surface water body may support sensitive aquatic ecological receptors and is used for public water supply / medium scale industrial or agricultural use. **Groundwater**: Groundwater body supports public water and/or large-scale industrial water supply and is a high productivity aquifer. **Flood Risk**: Land is within a high to medium risk flood zone or locally significant infrastructure is present which is protected from flooding by natural floodplain storage.
Medium	Receptors with a moderate capacity to accommodate change, is of minor value with small levels of contribution to the local, regional and national economy. Receptor is somewhat vulnerable to impacts that may arise from the development and has moderate to high levels of recoverability. **Surface Water**: WFD current overall status of moderate. The surface water features may be locally important for spawning of Salmonid species. Surface water body is used for private water supply or small scale industrial/agricultural use. **Groundwater**: Groundwater body supports private water supply or medium scale agricultural/industrial abstractions. **Flood Risk**: Land is within a medium risk flood zones or limited constraints and a low probability of flooding of industrial properties.

Sensitivity	Typical Descriptors
Low	Receptor with a high capacity to accommodate change, is of low value with little contribution to the local, regional or national economy. Receptor is not generally vulnerable to impacts that may arise from the development and/or has high recoverability. **Surface Water**: WFD current overall status of poor. Surface water bodies are not significant in terms of sensitive ecological receptors or fish spawning. Small scale (single residential or commercial use) abstraction licences are present in close proximity. **Groundwater**: Low or very low productivity aquifer with no abstraction licences. **Flood Risk**: Land within a low-risk flood zone or limited constraints and a very low probability of flooding of industrial properties.
Negligible	Receptor with a very high capacity to accommodate change, is of negligible value with no contribution to local, regional or national economy. Receptor is not vulnerable to impacts that may arise from the development and/or has high recoverability. **Surface Water**: WFD current overall status of bad. No sensitive ecological receptors or fish spawning are present within the surface water bodies. No abstraction licences present within the area. **Groundwater**: Very low productivity aquifer with no abstraction licences. **Flood Risk**: Land is within a little to no flood risk zone and no major flood risk areas are present within a 250 m radius of the site.

Magnitude of Impact

8.27 In determining impact magnitude, the impact duration and the nature of the impact has been taken into account. The following definitions from the DMRB (LA104 and LA113) have been used in the assessment.

- Temporal Scale:
  - Short Term: A period of months, up to one year;
  - Medium Term: A period of more than one year, up to five years;
  - Long Term: A period of greater than five years.
- Geographical scale: whether the effect would be experienced at the local, regional or national level.
- Adverse or Beneficial – whether the nature of the effect increases or decreases potential contamination risks to sensitive receptors.
- Temporary – effects that persist for a limited period only (due for example, to particular activities taking place for a short period of time).
- Permanent – effects that result from an irreversible change to the baseline environment (e.g. land-take) or which persist for the foreseeable future.
- Reversible/irreversible effect: effects can be reversed by mitigation measures or by natural environmental recovery within reasonable timescales (e.g. 5-10 years following cessation of construction).
- Direct – effects that arise from the impact of activities that form an integral part of the Proposed Development (e.g. direct employment and optics).
- Indirect – effects that arise from the impact of activities that do not explicitly form part of the Proposed Development.

8.28 The following terms have been used to describe magnitude, detailed in **Table 8.3.**

Table 8.3: **Definitions of Magnitude Used within this Assessment**

Sensitivity	Typical Descriptors
High	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements (Adverse).
	Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality (Beneficial).
Medium	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements (Adverse).
	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality (Beneficial).
Low	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements (Adverse).
	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring (Beneficial).
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features or elements (Adverse).
	Very minor benefit to or positive addition of one or more characteristics, features or elements (Beneficial).
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.

Significance of Effects

8.29 The significance of predicted effects has been determined taking into account the sensitivity of the receptor (taking into account the publicly available flood risk and environmental data provided by NRW, WCBC and the BGS), magnitude of impact and national and local flood risk polices outlined above, which define key objectives in relation to flood risk and drainage, to minimise the risk of flooding and polluting runoff within a site and to the surrounding area. **Table 8.4** below is used to inform the evaluation of the significance of effects.

Table 8.4: **Assessment Matrix**

Sensitivity	Magnitude of Impact				
	No Change	**Negligible**	**Low**	**Medium**	**High**
Negligible	No change	Negligible	Negligible or Minor	Negligible or Minor	Minor
Low	No change	Negligible or Minor	Negligible or Minor	Minor	Minor or Moderate
Medium	No change	Negligible or Minor	Minor	Moderate	Moderate or Major
High	No change	Minor	Minor or Moderate	Moderate or Major	Major or Substantial
Very high	No change	Minor	Moderate or Major	Major or Substantial	Substantial

8.30 The overall significance of an effect is expressed as negligible, minor, moderate, major or substantial based on the definitions below.

- Substantial: Only adverse effects are normally assigned this level of significance. They represent key factors in the decision-making process. These effects are generally, but not exclusively, associated with sites or features of international, national or regional importance

that are likely to suffer a most damaging impact and loss of resource integrity. However, a major change in a site or feature of local importance may also enter this category.

- Major: These beneficial or adverse effects are considered to be very important considerations and are likely to be material in the decision-making process.
- Moderate: These beneficial or adverse effects may be important, but are not likely to be key decision-making factors. The cumulative effects of such factors may influence decision-making if they lead to an increase in the overall adverse effect on a particular resource or receptor.
- Minor: These beneficial or adverse effects may be raised as local factors. They are unlikely to be critical in the decision-making process, but are important in enhancing the subsequent design of the Proposed Development.
- Negligible: No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

8.31 For the purpose of this assessment, any effect that is moderate, major or substantial is generally considered to be significant. Any effect that is minor or below is considered not significant.

Limitations of the Assessment

8.32 The report is based on publicly available hydrological and flood risk data extracted from the NRW website (DataMapWales A Geo-Portal for Wales) and the 2013 WCBC Local Flood Risk Management Strategy and 2013 WCBC Preliminary Flood Risk Assessment. Additional information was also supplied by stakeholders during the scoping stage.

8.33 The information collected through publicly available searches and through consultation with the relevant stakeholders is considered sufficient to characterise the baseline environment.

8.34 The following data were not available and consequently the assessment is based on the above freely available datasets:

- flow data for surrounding watercourses and drainage channels;
- detailed site-specific ground investigation data;

8.35 Overall, there is a high level of certainty associated with details of the baseline environment and with the findings of the assessment presented in this chapter. The available information is considered sufficient to establish baseline within the hydrological and geological study areas for the purposes of EIA. Therefore, there are no data limitations that affect the robustness of the conclusions of this assessment.

Baseline Environment

8.36 This section describes the hydrological resources and flood risk within the study area.

Site Description and Topography

8.37 The Site is located on land at Plas Power Estate, Ruthin Road, Wrexham, with the nearest postcode LL11 3BS. It is situated 2.5 km to the west of Wrexham town centre and immediately west of the A483.

8.38 The Site occupies a total area of 136 hectares (ha). The site is situated within an agricultural setting with arable and pastural lands at the site and surrounding the site area.

8.39 The Site generally slopes from the north from approximately 180m Above Ordnance Datum (AOD) towards the east with levels at approximately 102m AOD.

Hydrological Setting

8.40 A review of published OS maps and NRW data shows the Proposed Development does not have any main watercourses or ordinary watercourses present at the site. Agricultural field drains are present at the site.

8.41 There are watercourses in proximity. These watercourses all form part of the River Dee catchment.

8.42 A tributary of the River Gwenfro is located approximately 260m north east this flows in a south easterly direction and feeds into the River Gwenfro, a main river located approximately 410m northeast. FEH Webservice mapping shows the northern land parcel (north of the A525) flows north easterly into this tributary. The site is situated within the middle extent of the River Gwenfro catchment.

8.43 The River Clywedog is located approximately 45m south, this flows in an easterly direction and feeds into the River Dee approximately 30km south east. A tributary of the Clywedog is also located adjacent east of the site. According to the FEH Web Service the southern land parcel (south of the A525), in the centre and north flows are directed in an easterly direction to a tributary of the River Gwenfro. In the south flows are directed in a southerly direction directly into the River Clywedog. The site is situated along the middle reach of the catchment. Eventually the river feeds into the River Dee, approximately 35km east.

Surface Water Body Status

8.44 Under the WFD, hydrological features often contribute either directly or indirectly to the overall framework designation. Hydrological designations within the Proposed Development area are provided at an international and national level.

8.45 The watercourses within the 250m buffer of the site are all part of the Dee catchment.

8.46 The waterbody is allocated a WFD surface water classification presented in **Table 8.5.**

Table 8.5*:* WFD Surface Water Classifications

Waterbody Name	Waterbody Type	Classification (2018)	Overall Objective
River Cylwedog – above Black Brook (ID: GB111067051720)	Surface Watercourse (Calcareous)	Overall – Moderate	Good by 2027
River Gwenfro (ID: GB111067051730)	Surface Watercourse (Calcareous)	Overall – Moderate	Good by 2027

Geological and Hydrogeological Setting

Bedrock Geology

8.47 BGS Geology Viewer (1:50,000 scale) indicates that the bedrock geology varies across the site.

8.48 The northern half is comprised of Cefn Rock (sandstone) in northern half of the northern boundary of the site, and Pennine Lower Coal Measures Formation and Pennine Middle Coal Measures Formation (sandstone). The latter underlays a small area in the south-eastern corner of the northern

site plan, as well as located in the southern site plan at varying locations, largely in the centre and south of the site.

8.49 Online EA maps show that the Site is not located within a Groundwater Source Protection Zone.

8.50 A detailed description of the underlying geology is presented in the FCA (**Appendix 8.1**).

Superficial Deposits

8.51 BGS Geology of Britain mapping (1:50,000 scale) indicates the superficial geology deposits across site are comprised of Glacial Till Devensian and Glaciofluvial Sheet Deposits, Devensian (sand and gravel).

Hydrogeology

8.52 BGS Geology of Britain mapping show approximately 170 borehole records on the southern part of the site all relating to opencast mining and unavailable for inspection. The one log available from these records (ref: SJ35SW/46) indicates that no groundwater was struck during drilling.

8.53 A borehole log in the northern land parcel (ref. SJ25SE/42) was reviewed and identified a water strike at a depth of 6.00 m below ground level at the interface between the Glacial Till and the Glaciofluvial Deposits.

Groundwater Body Status

8.54 BGS Aquifer Designation mapping shows bedrock deposits are categorised as a Secondary A Aquifer which generally support water supply and base river flow on a more local scale. The underlying superficial geology deposits are classified as either a Secondary A Aquifer (Glaciofluvial Deposits) or Secondary Undifferentiated Aquifer (Glacial Till). Secondary Undifferentiated Aquifers have varying characteristics in different locations.

8.55 NRW Interactive Map Viewer shows the site is located within areas of Medium – High, Medium – Low and Low groundwater vulnerability and is not located within a Groundwater Source Protection Zone. There are no current groundwater abstractions within 500 m of the site.

Table 8.6: WFD Groundwater Classification

Name (NRW ID)	Water Body Type	Classification (2019)
Dee Carboniferous Coal Measures (ID: GB41102G204800)	Groundwater	Overall – Poor

Existing Flood Risk

Flood Map for Planning

8.56 The NRW Flood Map for Planning (FMfP) flood zones refer to the probability of flooding from rivers and sea in a given year, assuming no defences are in place and including climate change. Flood zone definitions are set out within **Table 8.7.**

Table 8.7: FMfP flood zones

Flood zone	Flood zone definition
Flood zone 1	land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%).
Flood Zone 2	land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year.
Flood Zone 3	land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

8.57 A revised edition of TAN 15 is due to be implemented in early 2024 and will be supported by the new FMfP to demonstrate how flood risk will be affected by climate change in the next century. The FMfP has been used to inform flood risk, irrespective of the status of the new TAN 15.

Development Advice Map

8.58 The Welsh Government produces Development Advice Maps (DAM) to accompany TAN 15. These maps show the degree of flood risk which is to be applied to the site for the planning process and thus establish the suitability of the site for development. These maps are based upon the NRW flood maps and similarly they can be modified through the presentation of data (i.e. hydraulic modelling) to illustrate that a site is within a different flood zone. The development advice zones are described on the Development Advice Map and are listed below, alongside their attributed planning actions:

- Zone A: Areas considered to be at little or no risk of fluvial or tidal/coastal flooding. Flood risk within this zone does not need to be considered further.
- Zone B: Areas known to have been flooded in the past evidenced by sedimentary deposits. Areas within this zone are further checked against the 0.1% flood level.
- Zone C1: Based on Environment Agency 0.1% flood outline and are areas of the floodplain developed served by significant flood defence infrastructure.
- Zone C2: Based on the Environment Agency 0.1% flood outline and areas of the floodplain without significant flood defence infrastructure.

Fluvial and Coastal Flood Risk

8.59 The FMfP shows the site to be located within Flood Zone 1.

8.60 The Development Advice Map, available online, indicates the site is located within Zone A.

8.61 The current NRW Flood Risk from Rivers and Sea mapping, available online, shows the entirety of the site is located at very low risk of flooding from fluvial and coastal flood sources.

Surface Water Flood Risk

8.62 The NRW Flood Risk from Surface Water Map, available online, indicates that the site is predominantly at “very low” risk of surface water flooding. This means that each year this area has a chance of flooding of less than 0.1%.

8.63 There is a defined flow path, which runs from the centre of the site flowing west to east and forms areas of ‘low’, ‘medium’, and ‘high’ risk of flooding. This corresponds to areas having a change of flooding between 1 in 1000 (0.1%) and 1 in 100 (1%), between 1 in 100 (1%) and 1 in 30 (3.3%) and

greater than 1 in 30 (3.3%), respectively. Depths along this flow path are predicted to reach over 0.9m in an around the centre of the site. Flow velocities are predicted to be between less than 1 and up to 3m/s.

8.64 Another flow path is indicated to be at a 'low', 'medium', and 'high' risk of surface water flooding in the far south-eastern corner of the site. Flood depths are predicted to range from less than 0.15m to 0.9m, with the depths becoming greater the further south the risk is predicted. The direction of the flow is predicted to be south with flow velocities predicted to be 1 to 2m/s.

8.65 Smaller flow paths are noted across the site, including the south and west of the southern part of the site, and in the centre and north of the northern part of the site. Depths are predicted to range from 0.15m to 0.9m, with flow velocities ranging from less than 1m/s up to 2m/s. The direction of flow in the northern half of the site is towards to the northeast, towards the direction of the ordinary watercourse River Gwenfro. The flow paths noted in the southern half of the site are predicted to flow in all directions.

Reservoir Flood Risk

8.66 The NRW Flood Risk from Reservoirs map, available online, shows the site is located outside the mapped extent of being at risk of flooding from this source.

Groundwater Flood Risk

8.67 BGS Aquifer Designation mapping shows bedrock strata are categorised as a Secondary A Aquifer. The Superficial Deposits are identified as either a Secondary A or Secondary (Undifferentiated) aquifer and the NRW natural environment mapping shows that the site is located within an area of Medium – High (Glaciofluvial Deposits), Medium – Low (Glacial Till) and Low (former opencast workings) groundwater vulnerability.

8.68 The WCBC Preliminary Flood Risk Assessment (PFRA) does not have records of groundwater flooding in the vicinity of the site.

8.69 Further detail on all sources of flood risk can be seen within Flood Consequence Assessment and Conceptual Surface Water Drainage Strategy (**Appendix 8.1**).

Ecological Designated Sites

8.70 There are no designated sensitive areas (e.g. SACs, SPAs or SSSIs) on site or within the 1km buffer zone.

8.71 However, the site is part of the wider Dee catchment, this river is situated in the River Dee and Bala Lake SAC and SSSI. However, given the distance of the site from these designated areas; over 25km, it is anticipated that the site will have a limited impact on these designated areas.

8.72 Ecological designation sites are therefore scoped out and not considered further within the report.

8.73 Further information regarding designated sites can be found in Chapter 5: Ecology and Nature Conservation.

Water Supplies and Abstraction

8.74 The NRW Permit and Licence Public Register website confirms there are no abstraction and water supply licences within a 1 km radius of the site. Water supply is therefore not considered further within the report.

Pollution Incidents

8.75 An Envirocheck report obtained for the site indicates a pollution incident to controlled waters occurred 645m and 685m in 1991 and 1995, respectively. These occurred from 'Waste Handling Facilities.' In 1991 the incident was caused by an accidental spillage of sewage from a Septic Tank Effluent, it was classified as a significant incident. In 1995 the incident was caused by accidental spillage/leakage of algae, it was classified as a minor incident. The site no longer appears to be in use as 'Waste Handling Facilities.'

Future Baseline Conditions

8.76 The Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017, as amended require that "*A description of the relevant aspects of the current state of the environment…. and an outline of the likely evolution thereof without implementation of the development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge*". This requirement is included within this EIA Report.

8.77 This section considers the likely future baseline conditions in the absence of the Proposed Development.

8.78 The main change to the hydrology and flood risk baseline in future is likely to be associated with the potential effects of climate change, which may impact on future peak river flow rates and rainfall intensity. NRW has considered the likely future changes and provides climate change allowances for flood consequence in land use planning (NRW 2021). A summary of potential changes is detailed in the document 'Flood Consequences Assessments: Climate change allowances' which can be found at https://gov.wales/sites/default/files/publications/2021-09/climate-change-allowances-and-flood-consequence-assessments_0.pdf).

8.79 A predicted increase in peak river flow rates and rainfall intensity, as outlined within the Centre for Ecology & Hydrology (CEH) 2011 study is likely to affect Wales and the Western Wales catchment. However, it is expected the gradient of the site will encourage the conveyance of flows eastwards, away from the site and therefore it is unlikely that any increase in peak river flow would cause flooding at the site. The Proposed Development is not located within a fluvial flood risk area. As such there is no climate change information available to assess future conditions.

8.80 The impacts of climate change on rainfall intensity have been accounted for in the conceptual drainage strategy in Appendix 8.1. As such the assessment and calculations take into account the future baseline surface water risk at the site.

Mitigation Measures Adopted as Part of the Proposed Development

8.81 This section details the mitigation measures that are proposed as part of the Proposed Development during both the construction and operational phases. The decommissioning stage mirrors the construction phase mitigation plans.

8.82 Potential impacts on the water environment would be avoided where practicable through careful consideration of the drainage design, construction techniques and operational industry practices.

8.83 An oCEMP and an oCTMP (provided at **Appendix 2.2** and **Appendix 2.3** of this ES) provide the framework and requirements for managing the construction activities and movement of traffic to and

from the site in order to reduce the impact on the environment and local road network during the construction period of the Proposed Development as far as practicable.

8.84 As part of the design process, a number of mitigation measures have been proposed to reduce the potential for impact on flood risk and hydrological environment. These measures are considered good industrial practice for this type of development and therefore have been incorporated as 'designed in' mitigation and management measures within the base scheme design as assessed within the potential impacts.

8.85 Measures adopted as part of the Proposed Development would be:

- Inclusion of a Flood Consequence Assessment to support the planning application due to the overall size of the site being in excess of 1 ha. This details mitigation measures in line with planning policy so that the development is safe throughout its lifetime.
- Relevant permits and consents will be obtained from NRW and WCBC prior to construction, these would include land drainage consents, as required.
- Construction phase mitigation would be implemented through the oCEMP which considers ways of reducing construction activity residues and emissions as far as practicable, including spills, noise, vehicle emissions etc. during the construction phase.
- Prior to decommissioning, measures to manage decommissioning of the site in particular to reduce the temporary storage of materials as far as practicable will be implemented. It is considered that the impact of this will be in line with the Construction Phase.

Construction

Construction Drainage Systems

8.86 During the construction phase of the Proposed Development, temporary drainage mitigation techniques would be used, including, but not limited to, runoff interceptor channels installed prior to the construction of the operational drainage design so that discharge from the site is controlled in quality and volume during construction. The construction drainage system would be designed so that any runoff produced would be treated before being discharged to the surrounding environment. This may include the use of settling tanks and/or ponds to remove sediment, temporary interceptors, and hydraulic brakes. Any drainage service runs would be surrounded by appropriate granular bedding material to reduce any potential leaks from infiltrating into the below groundwater body. Monitoring would be undertaken and any damage to the temporary drainage network would be repaired/replaced.

Construction Techniques and Processes

8.87 Dust suppression equipment would be used to reduce the spread of sediment within the Site, so that any dust created during construction is diverted into specific drainage systems equipped with sediment interceptors.

8.88 Where required, cables would be laid at a sufficient depth beneath watercourses to avoid causing damage to the integrity of embankments during installation.

8.89 Construction material and / or spoil within construction compounds would be positioned away from surface watercourses / significant ecological areas (where available) and no hazardous substances would be stored within close proximity of the drainage network.

8.90 The main construction compounds and storage areas would be positioned within the western part of the Site away from the surface watercourses.

8.91 Any area at risk of spillage, such as vehicle maintenance areas and hazardous substance stores (including fuel, oils and chemicals) would be bunded and carefully sited to reduce the risk of hazardous substances entering the drainage systems, the local watercourses, as far as practicable. Additionally, the bunded areas would have impermeable bases to limit the potential for migration of contaminants into surrounding watercourses and significant ecological habitats following any potential leakage/spillage event.

8.92 In line with standard building practices and as a precautionary measure, it is recommended that ground floor threshold levels of ancillary buildings would be raised a minimum of 150 mm above external ground levels, where feasible.

Excavation and Piling Mitigation Measures

8.93 Mitigation measures would be incorporated into the construction techniques to continue to protect groundwater flow and quality. During any piling and / or foundation excavation of ancillary buildings and BESS, the area would be isolated from surface water until completed. Should any groundwater be encountered during excavation, appropriate dewatering methods would be considered. Any water arising from excavations would be disposed through the temporary drainage system (if uncontaminated) and following removal of silt. Should contamination be encountered during excavation, work would be stopped until appropriate measures are in place to prevent mobilisation. Good practice construction techniques and design would be used for any excavations during the installation of foundations.

Pollution Prevention Measures

8.94 Refuelling of machinery would be undertaken within designated areas where spillages can be easily contained. Machinery would be routinely checked so that it is in good working condition.

8.95 Any tanks and associated pipe work containing hazardous substances included in List 1 of the Groundwater Directive (2006/118/EC) would be double skinned and be provided with intermediate leak detection equipment.

8.96 The following specific mitigation measures for the protection of surface water during construction activities would be implemented.

- Management of construction works to comply with the necessary standards.
- A briefing for all staff highlighting the importance of water quality, the location of watercourses and pollution prevention included within the site induction.
- Areas with prevalent runoff to be identified and drainage actively managed, e.g. through bunding and / or temporary drainage.
- Areas at risk of spillage, such as vehicle maintenance areas and hazardous substance stores (including fuel, oils and chemicals) to be bunded and carefully sited to reduce the risk of hazardous substances entering the drainage system or the local watercourses as far as practicable. Additionally the bunded areas would have impermeable bases to limit the potential for migration of contaminants into groundwater following any leakage / spillage. Bunds used to store fuel, oil etc. would have a 110% capacity of the volume of fuel, oil etc. to be stored.
- Disturbance in areas close to watercourses reduced to the minimum necessary for the work.
- Excavated material to be placed in such a way as to avoid any disturbance of areas near to the banks of watercourses and any spillage into the watercourses.

- Construction materials to be managed in such a way as to effectively reduce the risk posed to the aquatic environment as far as practicable.
- Plant machinery and vehicles to be maintained in a good condition to reduce the risk of fuel leaks.
- Drainage works to be constructed to relevant statutory guidance in consultation with NRW and WCBC prior to the commencement of construction.
- Consultation with NRW during the construction period to promote good practice and to implement proposed mitigation measures.

Water Quality Monitoring

8.97 Water quality monitoring would be carried out throughout the construction phase so that no discharge of pollutants or increase in suspended sediment occurs. A water quality monitoring methodology, location and schedule would be developed in consultation with consultees.

Best Practice Measures

8.98 The following measures have been determined as good practice measures based on local and national guidance. Construction work would be undertaken in accordance with the oCEMP, and relevant guidance, where appropriate. This guidance includes but is not limited to the following.

- Control of Water Pollution from Construction Sites – Guidance for Consultants and Contractors CIRIA (C532; 2001).
- CIRIA – SuDS Manual (C753; 2015a).
- CIRIA (C741; 2015b) Environmental good practice on site guide.
- Prevent surface water being affected during earthwork operations. No discharge to surface watercourses would occur without permission from NRW (SuDS Manual).
- Wheel washers and dust suppression measures to be used as appropriate to prevent the migration of pollutants (SuDS Manual).
- Regular cleaning of roads of any construction waste and dirt to be carried out (SuDS Manual).
- A construction method statement to be submitted for approval by the responsible planning authority (SuDS Manual).

8.99 NRW Guidance for Pollution Prevention would also complied with during the construction of the Proposed Development.

Operational Phase

Conceptual Surface Water Drainage Strategy

8.100 The Surface Water Drainage Strategy for the Proposed Development is detailed within the Flood Consequence Assessment and Conceptual Drainage Strategy (within **Appendix 8.1**).

8.101 The Solar Arrays are designed to avoid surface water sheeting/pooling/erosion, with water designed to drip off the arrays at multiple points onto vegetated ground below. In addition, there is significant space between rows (typically around 2.5m) to act as natural filter strips SuDS with vegetated ground that slows the movement of surface water. The vegetation will be managed organically and will either be mowed or used for light grazing and will bring multifunctional benefits, including the generation of renewable energy and landscaping and habitat creation to improve biodiversity. It is proposed that the internal access tracks will be fully permeable with no tarmac or other hardstanding

type surface. Most will follow existing farm tracks so would not be new access routes. As such they will have no impact with respect to surface water drainage. Geotextile membrane layers will help to secure the aggregate to prevent it sinking into the soil and this will help prevent ground compaction.

8.102 Regarding the ancillary buildings. e.g. proposed inverter units, transformers, substations, storage, monitoring house and GRP cabinet it is proposed to incorporate a gravel subbase, constructed with appropriate material to provide a 30% void ratio.

8.103 The additional impermeable area from the BESS and associated ancillary features is to be accommodated via an attenuation basin. This will attenuate water before controlled discharge to the greenfield runoff rate, via the ordinary watercourse to the east.

8.104 In addition, swales are proposed at the location of the solar panels in order to capture and slow runoff to provide a betterment. This will capture runoff and be infiltrated into the below ground. Further details of the drainage strategy are detailed in the FCA and Conceptual Drainage Strategy (**Appendix 8.1**).

Operational Procedures and Measures

8.105 A number of operational procedures would be developed for the Proposed Development which would look to prevent any increase in pollutants to the surrounding environment. An emergency spill response procedure and a site storage procedure would outline how a spill would be cleaned when the Proposed Development is operational and where any potential pollutants would be stored. This would be available within an operational management plan which would be kept in the main office with technical notes of important procedures available within each area of the site. Such procedures would likely be required as part of an Environmental Permit for surface water discharge.

Assessment of Construction Effects

8.106 The construction effects of the Proposed Development have been assessed in relation to hydrology and flood risk within the defined study area. Temporary impacts during the construction phase would mainly be due to any temporary alteration of the existing surface water flow regimes as a consequence of the Proposed Development. The construction impacts assessed are as follows:

- impacts which may affect temporary (construction) flood risk;
- impacts on surrounding surface water resources.
- The effects are summarised in **Table 8.8**.

Temporary (Construction) Flood Risk

8.107 The site has been assessed as being at very low risk of fluvial and coastal flooding and the majority of the site has a ‘very low’ risk of surface water flooding. There are flow pathways across the site, comprising of a low-high risk.

8.108 Flows are assumed to comprise of surface water runoff following high intensity rainfall events and following the elevation and local depressions of the land.

8.109 As outlined in the current baseline conditions section, the Site is currently used of pastural and arable agricultural land and is defined as greenfield. An increase in hardstanding would occur due to use of areas as construction laydown areas and construction compounds. The access roads will not increase the hardstanding areas since it will be covered by gravel. Where the tracks connect to the main road in the north there will be a minor addition of impermeable surface.

8.110 During construction of the Proposed Development, there is a potential for increased flood risk from surface water as a result higher rates of surface water runoff from increased impermeable areas. During construction phase this includes construction compounds, haul road and construction accesses.

8.111 Construction activities associated with installation of the underground cable have the potential to impact upon the surface water drainage regime and water quality as a result of earthworks operations and excavation of the cable trench.

8.112 Measures will be implemented so that the risk of flooding is not increased during the construction phase. The temporary construction compound(s) will be constructed using permeable material underlain by a permeable geotextile membrane. Surface water runoff will be intercepted via a temporary drainage system. The system will manage surface runoff from the construction compound in terms of both flow rate and water quality in accordance with local policies.

8.113 At the end of its operational life, the decommissioning of the site is considered to have similar effects upon the environment as those during construction stage, and therefore, similar measures to reduce the effects are likely to be proposed.

Sensitivity of Receptors

8.114 Flows from the site contribute to the upland catchments of the River Gwenfro and River Clywedog. The Proposed Development is located within upland sections of the watercourse catchments and as such have a limited ability to absorb any changes in hydrological regime from temporary construction activities. The watercourse receptor is considered to be of a high vulnerability and, moderate value. The sensitivity of the receptor is therefore classified as **high.**

8.115 A highway drainage ditch is located along the A525. Further field drains are located at the site. The watercourse receptor is considered to be of a high vulnerability and, moderate value. The sensitivity of the receptor is therefore classified as **high.**

8.116 Within the study area, adjacent land to the Proposed Development comprises a mixture of rural and agricultural land and urban settlements of Coedpoeth, Southsea and Bersham. A number of roads including the A483 and A525 are also located within the study area. Adjacent land is of high vulnerability, and high value. The sensitivity of the receptor is therefore, considered to be **high**.

8.117 Site users during this phase of the Proposed Development will be construction workers and any users of the public footpaths and access tracks who are assessed to be highly vulnerable, high value and an overall **high** sensitivity.

Magnitude of Impact

8.118 Impacts on flood risk would arise from any temporary change in runoff over the areas affected during construction, such as construction compounds, haul road and construction accesses. However, as construction is not anticipated to result in a significant change of the amount of existing impermeable areas within the site, site run-off rates and hydrological characteristics are not expected to deviate from baseline conditions.

8.119 The effects of the construction of the cable route would be localised and temporary and controlled using measures set out within the oCEMP. In addition, the cable route would be dug deep enough under the River Clywedog as to avoid risk of damage and appropriate consent would be sought through NRW. As a result, the magnitude of impact upon the surface water drainage regime and water quality during construction of the cable route would be **negligible adverse.**

8.120 The impacts on flood risk from the temporary change in runoff are only likely to affect the surrounding local receptors and, assuming that designed in and construction measures are implemented, there is unlikely to be any observable degradation in flood risk. The magnitude of impact is predicted to be indirect, of local spatial extent, short term duration and continuous. The impact magnitude is therefore considered to be **negligible adverse.**

8.121 As the impacts and mitigation proposed during decommissioning are considered the same as the construction stage, the potential impacts in respect to flood risk are therefore anticipated to be **negligible adverse.**

Significance of Effect

8.122 Overall, the sensitivity of the receptors is considered to be **high** and the magnitude of the impact with mitigation measures is deemed to be **negligible adverse**.

8.123 The effect will therefore be of **minor adverse** significance on surface water features, groundwater, adjacent land and site users, which is not significant in EIA terms.

Impact of Construction on Surrounding Water Resources

8.124 During construction, there is a potential risk of accidental discharges of untreated runoff containing contaminants. It is anticipated that any untreated runoff will eventually outfall to watercourses (main rivers and ordinary watercourses) located downstream. These watercourses and the untreated runoff also has the potential to infiltrate in-situ to superficial deposits and solid geology underlying the study area.

8.125 There are a number of potential pollutants which could arise during construction, and hence which may affect the water quality of receiving watercourses. These are outlined below:

- fine particulate materials (e.g. silts and clays);
- cement;
- oil and chemicals (from plant machinery and processes);
- Potential contamination sources associated with opencast backfill materials; and
- other wastes such as wood, plastics, sewage and rubble.

8.126 These pollutants may be present as a result of normal Proposed Development activities, such as excavation, incorrect storage of oils and chemicals and/or accidental spillage. The significance of the incident is dependent on the nature of the pollutant, on the mitigation measures adopted and their timing and effectiveness, and on the sensitivity of the receiving watercourse.

8.127 At the end of its operational life, the decommissioning of the site is considered to have similar effects upon the environment as those during construction stage, and therefore, similar measures to reduce the effects are likely to be proposed.

Sensitivity of Receptor

8.128 Flows from the site contribute to the upland catchment of the River Gwenfro, as well as contributing directly to the River Clywedog. Taking a precautionary approach in assuming surrounding waterbodies have achieved/maintained ‘good’ status at the time when construction begins, the surface watercourses and groundwater bodies within the study area will have been assessed with a WFD status of ‘good’. The watercourses and groundwater bodies are therefore considered to be

highly vulnerable in relation to WFD classification status, and moderate value in relation to the local economy. The sensitivity of the receptor is therefore, considered to be **high**.

8.129 Flows from the site can also discharge to ground and contribute to groundwater. Whilst the site is not located within a Source Protection Zone, groundwater bodies are considered to be highly vulnerable in relation to WFD classification status, and moderate value in relation to the local economy. The sensitivity of the receptor is therefore classified as **high**.

8.130 Site users during this phase of the Proposed Development will be construction workers and any users of the public footpaths and access tracks who are assessed to be highly vulnerable, high value and an overall **high** sensitivity.

Magnitude of Impact

8.131 Activities associated with machinery during construction could lead to an increase in turbid run-off and spillages/leaks of fuel, oil etc. that could affect nearby watercourses and groundwater bodies. There is the potential for this to impact on water quality and therefore cause a reduction in the WFD classification. The activities may result in a disruption of the ground where former coal mining occurred. Potentially resulting in contaminants flowing off site.

8.132 In regard to the cable route it is expected HDD will be used to pass beneath watercourses. The impacts on these watercourses from construction activities involving the use of HDD techniques and associated machinery could lead to an increase in turbid runoff, high pH water runoff, bentonite breakouts during drilling and spillages/leaks of fuel, oil etc. affecting nearby watercourses. There is the potential for this to impact on water quality and therefore cause a reduction in the WFD classification.

8.133 Trenched techniques may be used where the export cable route or the haul road cross smaller watercourses (that are frequently dry) and drainage channels. Trenching could lead to damage to the banks along the watercourses, an increase in turbid runoff, spillages/leaks of fuel, oil etc. and an alteration in surface water flow pathways that could affect nearby watercourses.

8.134 The construction process would include measures to intercept run-off so that discharges from the site are controlled in quality and volume causing no degradation in WFD classification. In addition, water quality monitoring could be carried out throughout the construction phase so that no discharge of pollutants or increase in suspended sediment occurs. The impact is predicted to be of local spatial extent, short term duration, intermittent and medium reversibility. The magnitude is therefore, considered to be **negligible adverse**.

8.135 As the impacts and mitigation proposed during decommissioning are considered the same as the construction stage, the potential impacts in respect to water resources are therefore anticipated to be **negligible adverse.**

Significance of Effect

8.136 Overall, the sensitivity of the receptors is considered to be **high** and the magnitude of the impact with mitigation measures is deemed to be **negligible adverse**. The effect will therefore be of **minor adverse** significance on surface water features, groundwater and site users, which is not significant in EIA terms.

Further Mitigation

8.137 Suitable mitigation measures have been adopted as part of the Proposed Development and would be implemented through the oCEMP. In addition, the oCEMP and an oCTMP (provided at **Appendix**

2.2 and **Appendix 2.3** of this ES) provide the framework and requirements for managing the construction activities and movement of traffic to and from the site in order to reduce the impact on the environment and local road network during the construction period of the Proposed Development as far as practicable. Further ground investigation is recommended in the DTS and PRA (**Appendix 4.7**) in order to clarify any potential contamination sources associated with opencast backfill materials. It is recommended that further investigation is undertaken pre-determination and on completion, any necessary mitigation measures will then be put in place.

8.138 Therefore, this assessment has demonstrated that the construction of the Proposed Development would not cause any exceedances of the hydrology and flood risk objectives and that the overall effect would be 'not significant'. It is, therefore, not considered necessary to propose further mitigation measures for this Proposed Development.

Future Monitoring

8.139 The construction process includes measures to intercept run-off so that discharges from the Proposed Development are controlled in quality and volume, as well as water quality monitoring carried out throughout the construction phase so that no discharge of pollutants or increase in suspended sediment occurs.

Accidents and/or Disasters

As with most construction sites, there is potential for a spillage of fuel or oil on-site during the construction phase of works. Measures included within the oCEMP would mitigate any such incidence. The oCEMP would form the basis of more detailed plans and method statements, included in a detailed CEMP to be prepared during pre-construction phase by an appointed contractor. This will appropriately mitigate any risks associated with accidents and/or disasters at the Proposed Development.

Assessment of Operational Effects

8.140 The effects associated with operation and maintenance of the Proposed Development have been assessed in relation to hydrology and flood risk within the defined study area. The environmental impacts arising from the operation and maintenance of the Proposed Development are listed below:

- impact of presence and operation on flood risk (including climate change);
- impact of presence and operation on surrounding surface watercourses.

8.141 The effects are summarised in **Table 8.8.**

Impact of Operation on Flood Risk

8.142 Due to the existing elevation of the Site in comparison to the aforementioned fluvial and sea sources, the Site is located within an area with very low risk of flooding. However, the Proposed Development would increase impermeable areas within the site.

8.143 The Proposed Development has been subject to an FCA and a conceptual drainage strategy in order to meet the requirements of national and local planning policy and best practice. No fluvial climate change data is available for the site as the development is not situated within an at risk area, The surface water climate change risk includes attenuation for climate change to ensure that the development is safe throughout its lifetime.

8.144 It is expected solar panels will intercept precipitation falling upon areas of the site over-sailed by solar PV modules. This increase in impermeable area has the potential to increase surface water runoff from the baseline scenario.

8.145 The potential for increased runoff rates to occur is to be appropriately mitigated by features of the solar arrays themselves. The solar PV modules are to have a 12-to-18-degree pitch on the horizontal plane which will reduce the flow velocity of run-off landing on the solar PV modules. Furthermore, typical solar PV modules are constructed with 20mm gaps between each individual panel which allows surface water to drip to the vegetated ground beneath. This reduces the risk of water sheeting and runoff only occurring from the leeward edge of the modules.

8.146 Filter strip SuDS comprising of appropriately seeded vegetation below and between rows of solar PV modules are proposed to dissipate kinetic energy of surface water and promote low erosivity sheet flow during operation of the Proposed Development. Vegetation will be year-round organically managed vegetated ground cover and is expected to will promote a betterment of interception and infiltration of precipitation compared to existing intensive arable or livestock grazing use. Research undertaken by Cook and McCuen (2013) found that provided full vegetation cover beneath the solar PV modules is maintained, the change in run-off characteristics from solar PV module areas is likely to be insignificant and that ground cover has a much more important control over runoff.

8.147 Swales comprising of appropriately seeded vegetation will be provided along the downstream perimeter of solar PV module parcels to capture and attenuate any exceedance flows from solar PV modules following high intensity rainfall events. The sizing and discharge location of swales are subject to detailed drainage design and soakaway testing.

8.148 A conceptual drainage strategy has been prepared for impermeable areas associated with the ancillary buildings e.g. transformers, substations etc. With the incorporation of a drainage strategy, to be developed in consultation with the LLFA, it has been determined flows from impermeable area from the proposed ancillary buildings will accommodate the 1 in 100-year plus climate change event and thus slightly reduce the risk of flooding to areas downstream. When compared to the baseline, this slight reduction in flood risk to areas downstream introduces a slight beneficial effect.

BESS

8.149 The BESS components will be attenuated via a pond which will help filter any potential pollutants before discharge to a drainage channel at the site.

8.150 The management of this is detailed in the FCA and Conceptual Drainage Strategy (**Appendix 8.1**).

8.151 The magnitude of impact is predicted to be of local spatial extent and long-term duration. The impact magnitude is therefore predicted to be **negligible beneficial.**

Sensitivity of Receptors

8.152 Flows from the site contribute to the upland catchments of the River Gwenfro and River Clywedog. The Proposed Development is located within upland sections of the watercourse catchments and as such have a limited ability to absorb any changes in hydrological regime from temporary construction activities. The watercourse receptor is considered to be of a high vulnerability and, moderate value. The sensitivity of the receptor is therefore classified as **high.**

8.153 Within the study area, adjacent land to the Proposed Development comprises a mixture of rural and agricultural land and urban settlements of Coedpoeth, Southsea and Bersham. A number of roads including the A483 and A525 are also located within the study area. Adjacent land is of high vulnerability, and high value. The sensitivity of the receptor is therefore, considered to be **high**.

8.154 Site users during this phase of the Proposed Development will be site operatives and any users of the public footpaths and access tracks who are assessed to be highly vulnerable, high value and have an overall **high** sensitivity.

8.155 Magnitude of Impact with the incorporation of a drainage strategy to attenuate runoff from proposed impermeable areas, run-off rates and hydrological characteristics from the developed site are not expected to deviate from baseline conditions. Accordingly, impacts on flood risk during operation are not predicted to affect the adjoining receptors. The magnitude is, therefore considered to be **Negligible Adverse**.

Significance of Effect

8.156 Overall, the magnitude of the impact is deemed to be negligible, the sensitivity of the receptor is considered to be high.

8.157 The effect will, therefore, be of **minor adverse** significance on watercourses, adjacent land, and site users, which is not significant in EIA terms.

Impact of Operation on Water Resources

8.158 During the operation of the Proposed Development there are a number of potential pollutants, which may give rise to water quality effects on the surrounding surface watercourses and groundwater. These include:

- fine particulate materials (e.g. silts and clays);
- oils and chemicals (from plant machinery and processes); and,
- contamination from distrubed coal mining; and

Sensitivity of Receptor

8.159 Flows from the site contribute to the catchment of the River Gwenfro, and the River Clywedog. The site is situated along the middle extent of these catchments. Taking a precautionary approach in assuming surrounding waterbodies have achieved/maintained ‘good’ status at the time when construction begins, the surface watercourses and groundwater bodies within the study area will have been assessed with a WFD status of ‘good’. The watercourses and groundwater bodies are therefore considered to be highly vulnerable in relation to WFD classification status, and moderate value in relation to the local economy. The sensitivity of the receptor is therefore, considered to be **high**.

8.160 Flows from the site can also discharge to ground and contribute to groundwater. Whilst the site is not located within a Source Protection Zone, groundwater bodies are considered to be highly vulnerable in relation to WFD classification status, and moderate value in relation to the local economy. The sensitivity of the receptor is therefore classified as **high**.

8.161 Site users during this phase of the Proposed Development will be site operatives and any users of the public footpaths and access tracks who are assessed to be highly vulnerable, high value and have an overall **high** sensitivity.

Magnitude of Impact

8.162 Pollutants may be present as a result of normal operations, traffic and emergency or accidental spillage. These activities could lead to an increase in turbid run-off and spillages/leaks of fuel, oil

that could runoff to watercourses and infiltrate to superficial deposits and solid geology underlying the Proposed Development.

8.163 The conceptual drainage strategy includes the provision of SuDS to mitigate pollutants. Filter strips and swales are expected to provide sufficient treatment to the run-off from impermeable areas associated with solar PV arrays. The gravel bases in which ancillary buildings e.g. transformers, substations etc. is positioned upon will filter pollutants from associated impermeable areas.

8.164 Furthermore, it is expected operational procedures to prevent any increase in pollutants to the surrounding environment. An operational management plan and will include storage procedures of potentially polluting substances, emergency spill response procedures, clean up and remediation of contaminated water runoff. It is expected the site will not be permanently occupied and occasionally visited by site operatives to undertake inspection and maintenance activities. Site operatives will be fully briefed on operational procedures on-site, including pollution prevention and response procedures. With the provision of operational measures and on-site drainage networks, the magnitude of impact is assessed to be **low adverse**.

Significance of Effect

8.165 Overall, the magnitude of the impact is deemed to be low, the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **minor adverse** significance on surface water features, groundwater and site users which is not significant in EIA terms.

Further Mitigation

8.166 The Proposed Development includes a drainage strategy in order to effectively control operational flood risk and water quality. The assessment has demonstrated that the operation of the Proposed Development would not cause any exceedances of the hydrology and flood risk objectives and that the overall effect would be 'not significant'. It is, therefore, not considered necessary to propose further mitigation measures for this Proposed Development.

Future Monitoring

8.167 No further monitoring measures are required during the operational phase of the Proposed Development.

Accidents/Disasters

8.168 Potential direct effects on hydrology and flood risk (from a catastrophic failure of fuel and oil storage) are limited at the Proposed Development, which incorporates a surface water drainage strategy, petrol / sediment interceptors / separators to mitigate any such event. As a result, any direct and / or indirect water quality effects associated with the Proposed Development are unlikely.

8.169 In order to manage the risk associated with a highly unlikely fire event due to the BESS, the development will include both a provision for the supply of fire water via water tanks and/or hydrants, in addition containment of fire water used to supress any fire. A penstock system will be utilised.

8.170 Should there be any other spillages on the BESS Compound such as battery leakage or spillage of fuel from the transformers then any contaminated runoff would be managed and intercepted by the penstock system, as with the firewater outlined in **Appendix 8.1**.

8.171 Pollutants may be present as a result of normal operations, traffic and emergency or accidental spillage. These activities could lead to an increase in turbid run-off and spillages/leaks of fuel, oil

that could runoff to watercourses and infiltrate to superficial deposits and solid geology underlying the Proposed Development.

8.172 The Conceptual Drainage Strategy includes the provision of SuDS to mitigate pollutants. Filter strips and swales are expected to provide sufficient treatment to the run-off from impermeable areas associated with solar PV arrays. The gravel bases in which ancillary buildings e.g. transformers, substations etc. is positioned upon will filter pollutants from associated impermeable areas.

8.173 Furthermore, it is expected operational procedures to prevent any increase in pollutants to the surrounding environment. An operational management plan will include storage procedures of potentially polluting substances, emergency spill response procedures, clean up and remediation of contaminated water runoff. It is expected the site will not be permanently occupied and occasionally visited by site operatives to undertake inspection and maintenance activities. Site operatives will be fully debriefed of operational procedures on-site, including pollution prevention and response procedures. With the provision of operational measures and on-site drainage networks, the magnitude of impact is assessed to be low adverse.

8.174 The operation of the Proposed Development requires routine maintenance of key elements. Maintenance may involve the use of chemicals, oils, and greases and, there is the potential for spillages to occur which may affect the water quality of surrounding. Operational practices would involve management plans under appropriate Environmental Permits including spill procedures and clean up and remediation of contaminated water runoff in order to mitigate against any decrease in water quality status or damage to significant habitats. The effects of operation and maintenance on surrounding watercourses and groundwater bodies are not considered to be significant.

8.175 On the above basis, in the event of an accident / disaster, the Proposed Development includes a number of features and measures to contain, treat and manage pollution risk. Overall, the risk to population health and water quality is not considered significant.

Potential Changes to the Assessment as a Result of Climate Change

8.176 The assessment has demonstrated that the Proposed Development would not cause any exceedances of the hydrology and flood risk objectives, taking into account an appropriate allowance for climate change (20%) as detailed in PPW. No likely significant effects are anticipated.

Assessment of Decommissioning Effects

8.177 Predicted effects upon hydrology and hydrogeology during the decommissioning of the Proposed Development would be equivalent to those experienced during construction for the duration of the phase. As is in the construction phase, during decommissioning of the Proposed Development, there is a potential for increased flood risk from surface water as a result of higher rates of surface water runoff from temporary features placed to support the removal of the built environment. This may include compounds, haul road and accesses. There may be a temporary alteration of the existing surface water flow regimes because of the removal of the Proposed Development.

8.178 Activities associated with removal of the underground cable have the potential to impact upon the surface water drainage regime and water quality because of earthworks operations and excavation of the cable trench.

8.179 Potential environmental impacts during the decommissioning phase will be managed through implementation of management measures to be specified ahead of the decommissioning phase commencing. Temporary drainage measures would be put in place where required and the

temporary storage of materials will be reduced as far as practicable. Following decommissioning, the approach taken to construction allows the future quality of the agricultural land to be maintained with no lasting adverse effects on the quality of the soil. Water across the site will flow as is in the baseline hydrological conditions. Therefore, there will be no impact to flood risk, water resources or water quality. The site will be returned to the existing baseline hydrological conditions.

8.180 Overall, the decommissioning of the Proposed Development is not anticipated to cause any significant effects upon hydrology and hydrogeology.

Assessment of Cumulative Effects

8.181 This section considers the cumulative effects of the Plas Power Solar and Energy Storage Project on flood risk and hydrology in conjunction with the other developments set out in Chapter 4: Environment Assessment Methodology.

8.182 The potential cumulative impacts with other developments have been identified, assessing the likely significant effects (if any) against the baseline position.

8.183 A review of approved and Proposed Developments within a 1 km search area from the site has been undertaken. A 1 km search area is considered appropriate for data collection taking into account the nature of the development and likely zone of influence on hydrological receptors. Given the landscape surrounding the site, current and ongoing activities, as well natural baseline fluctuations, it would be difficult to ascertain the exact source of any impacts on flood risk and / or water quality beyond 1 km.

8.184 There are no major proposed or approved developments within a 1km search area of the site. All proposed and approved developments are considered to be minor, mainly consisting of extensions of residential developments and building conversions which are expected to only marginally deviate hydrological conditions from the baseline.

8.185 There are no large-scale developments that have been identified during the EIA process and therefore this ES considers the following cumulative schemes:

- Land South Of, Berse Road, Caego, Wrexham, LL11 6TP (P/2023/0221) – erection of 47 dwellings and associated infrastructure.
- Lower Berse Farm, Ruthin Road (A525), Wrexham (pre-application) – strategic development of 1,500 homes.
- Legacy National Grid Substation, Bronwylfa Road, Talwrn, Wrexham, LL14 4HY
- (P/2023/0175) – Installation and operation of battery storage facility and ancillary development.
- Legacy National Grid Substation, Bronwylfa Road, Talwrn, Wrexham, LL14 4HY (preapplication) 1,025 MW Energy Storage System.
- DNS/3237973 – Bersham Energy Plant.

Construction Phase

8.186 It is assumed, where relevant, in accordance with the national and local design policy, that new developments would be required to attenuate surface water run-off, where practicable, to the greenfield run-off rate and provide appropriate management techniques to treat potentially contaminated run-off prior to discharge into the local drainage network or surrounding surface water environment.

8.187 For consent to be obtained for any of the other Proposed Developments, the developer is required to demonstrate that the risk of flooding during the lifetime of the development could be mitigated to a level acceptable to PPG and WCBC. With such measures in place, cumulative effects on water resources and hydrology with other Proposed Developments are not predicted to be significant.

8.188 Therefore, it has been determined that no significant cumulative construction effects on water resources and hydrology receptors are likely.

Operational Phase

8.189 The other Proposed Developments listed would be subject to local and national policy. Under these policies, the developments would be required to demonstrate that the operational phase has a limited effect on water quality and would not increase flood risk to the site or the surrounding area. Without this, the above developments would not obtain planning permission and therefore never be in operation.

8.190 The developments would therefore have a series of operational mitigation and management measures which would limit any adverse cumulative effects. This would therefore result in a residual effect of the operational phase which is classified as not significant.

8.191 Therefore, it has been determined that no significant cumulative operational effects on the hydrology and flood risk receptors are likely.

Inter-relationships

8.192 The assessment includes the consideration of all potential impacts on hydrology and flood risk features, character, and water quality. This chapter also assesses hydrogeology. This topic has inter-relationships with landscape and visual (see Chapter 5) and biodiversity (see Chapter 6). In particular the landscape strategy has been designed in accordance with the drainage principles proposed for the site. No additional inter-related effects are considered likely to occur beyond those identified in these assessments.

Summary of Effects

8.193 An FCA and Conceptual Sustainable Drainage Strategy has been prepared which has assessed the Site to have a very low risk of flooding from fluvial and sea sources, a low risk of flooding from surface water and a very low to negligible risk of flooding from all other sources. The Proposed Development is defined as ‘Less Vulnerable’ according to the TAN15.

8.194 The FCA and Conceptual Drainage Strategy demonstrate that appropriate mitigation measures, a suitable drainage strategy / network, would be incorporated into the design to reduce the adverse impacts and attenuate any increase in surface water runoff. The FCA demonstrates that the Proposed Development meets the requirements of local and national policy.

8.195 The operation of the Proposed Development has the potential to increase volumes and rates of surface water runoff and in turn increase the flood risk to the Site and downstream. Appropriate operational management measures would be incorporated into the operational process in order to mitigate against any increase in runoff, including an outline drainage strategy. The effects to flood risk during the operation and maintenance phase in relation to the Proposed Development are not considered to be significant.

8.196 The construction/decommissioning is likely to result in a temporary change to the runoff only, with an impact on local receptors. Construction measures are implemented to reduce any observable degradation to flood risk.

8.197 Although construction/decommissioning has the potential to cause a degradation of water quality to watercourses and groundwater through an increase in soil erosion and accidental release of sediment, appropriate mitigation measures have been identified within this chapter to reduce potential impacts as far as practicable. The effects are not considered to be significant.

8.198 The operation of the Proposed Development requires routine maintenance of key elements. Maintenance may involve the use of chemicals, oils, and greases and, there is the potential for spillages to occur which may affect the water quality of surrounding. Operational practices would involve management plans under appropriate Environmental Permits including spill procedures and clean up and remediation of contaminated water runoff in order to mitigate against any decrease in water quality status or damage to significant habitats. The effects of operation and maintenance on surrounding watercourses and groundwater bodies are not considered to be significant.

8.199 Cumulative impacts with other Proposed Developments screened into the assessment have been assessed and no significant cumulative effects have been identified.

8.200 A summary of the findings of the hydrology and flood risk assessment is presented in **Table 8.8.**

Table 8.8: Summary of Likely Environmental Effects on Hydrology and Flood Risk

Receptor	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact (including mitigation)	Significance of effect	Significant / Not significant	Notes
Construction and decommissioning phases							
Surface watercourses	High	Risk of flooding and Pollution of watercourses	Short term	Negligible	Minor Adverse	Not Significant	-Direct -Temporary
Groundwater	High	Risk of pollution	Short term	Negligible	Minor Adverse	Not Significant	-Direct -Temporary
Surrounding Land	High	Risk of flooding and Risk of Pollution	Short term	Negligible	Minor Adverse	Not Significant	-Direct -Temporary
Site Users	High	Risk of flooding and Risk of Pollution	Short term	Negligible	Minor Adverse	Not Significant	-Direct -Temporary
Operational phase							
Surface watercourses	High	Risk of flooding and Pollution of watercourses	Long term	Low Adverse	Minor Adverse	Not Significant	SuDS will be included in Proposed Development and emergency procedures to be prepared.
Groundwater	High	Risk of pollution	Long term	Low Adverse	Minor Adverse	Not Significant	SuDS will be included in Proposed Development and emergency procedures to be prepared.
Surrounding Land	High	Risk of flooding and Risk of Pollution	Short term	Low Adverse	Minor Adverse	Not Significant	SuDS will be included in Proposed Development and emergency procedures to be prepared.
Site Users	High	Risk of flooding and Risk of Pollution	Short term	Low Adverse	Minor Adverse	Not Significant	SuDS will be included in Proposed Development and emergency procedures to be prepared. All site users will be briefed on risks before entering site.

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9 CLIMATE CHANGE

Introduction

9.1 This chapter of the ES presents the findings of the EIA assessing the likely significant environmental effects of the Plas Power Solar and Energy Storage Project (referred to in this report as the 'Proposed Development') on climate change.

9.2 Climate change in the context of EIA can be considered broadly in two parts:

- the impact of greenhouse gas emissions (GHGs) caused directly or indirectly by the Proposed Development (both beneficial and adverse), which contribute to climate change; and
- the potential impact of changes in climate on the Proposed Development, which could affect it directly or could modify its other environmental impacts.

9.3 This chapter is supported by the following appendices:

- **Appendix 9.1** – Climate Change Policy Review;
- **Appendix 9.2** – Climate Risk Assessment; and
- **Appendix 9.3** – GHG Calculations.

Assessment Methodology

Planning Policy Context

9.4 A summary of relevant policy is given in this section. Full references are provided in **Appendix 9.1**: Climate Change Policy Review.

9.5 PPW (Edition 12) highlights the importance of Wales's transition to a low carbon future in a changing climate and sets out the goal of generating at least 70% of its electricity consumption from renewable sources by 2030.

9.6 PPW sets out the duty of planning authorities to facilitate renewable and low carbon energy developments. Paragraph 5.9.1 states local authorities *"should seek to ensure their area's full potential for renewable and low carbon energy generation is maximised and renewable energy targets are achieved"*.

9.7 With regard to local policy, Wrexham Local Development Plan (2023) supports renewable energy development within Policy RE2. This policy states: *"Proposals to generate energy from renewable and low carbon sources will be supported. In assessing such proposals consideration will be given to the impacts of the development on the landscape, the number, scale, size, design and siting of renewable installations and associated infrastructure, alone, cumulatively and in combination."*.

Relevant Guidance

Legislation

9.8 The Climate Change Act 2008, as amended (2019), created a framework for setting a series of interim national carbon budgets and plans for national adaptation to climate risks. The Act requires the UK government to set carbon budgets[4] for the whole of the UK.

9.9 At present, the Fourth, Fifth and Sixth Carbon Budgets, set through The Carbon Budget Orders 2011, 2016, and 2021 are 1.95 giga tonnes carbon dioxide equivalent ($GtCO_2e$) for 2023-2027, 1.725 $GtCO_2e$ for 2028-2032 and 0.965 $GtCO_2e$ for 2033-2037 respectively. The Sixth Carbon Budget is the first Carbon Budget that is consistent with the UK's net zero target, requiring a 78% reduction in GHG emissions by 2035 from 1990 levels.

9.10 The UK's Nationally Determined Contribution (NDC) (HM Government, 2020) under the Paris Agreement to the United Nations Framework Convention on Climate Change (UNFCCC), submitted in December 2020, commits the UK to reducing economy-wide GHG emissions by at least 68% by 2030, compared to 1990 levels.

9.11 The Environment (Wales) Act 2016 provides Welsh ministers with powers to put in place statutory emissions reduction targets, including an aspiration to achieve net zero GHG emissions by 2050.

9.12 The Climate Change (Carbon Budgets) (Wales) (Amendment) Regulations 2021 regulates two carbon budgetary periods; the period of 2021-2025 limits GHG emissions to an average of 37% lower than the 1990 baseline (this is updated from 33% as stated within the 2018 Regulations), and the period of 2026-2030 limits GHG emissions to an average of 58% lower than the baseline. These reductions correspond to 0.08 $GtCO_2e$ for 2021-2025 and 0.12 $GtCO_2e$ for 2026-2030.

Guidance and Recommendations

9.13 The Climate Change Act 2008 also created the Committee on Climate Change, since renamed the Climate Change Committee (CCC) to give advice on carbon budgets and report on progress. The Committee, through its Adaptation Sub-Committee, also gives advice on climate change risks and adaptation.

9.14 The CCC's Sixth Carbon Budget report makes the following policy recommendations, with regard to renewable energy deployment (Committee on Climate Change, 2020):

- Reducing demand and improving efficiency: require changes that will reduce carbon-intensive activities and the improvement of efficiency in the use of energy and resources.
- Take-up of low carbon solutions: phase out fossil fuel generation by 2035.
- Expansion of low carbon energy supplies: increasing renewables to 80% of generation by 2050.

[4] A carbon budget places restrictions on the total amount of GHGs that can be emitted. The budget balances the input of CO_2 to the atmosphere by emissions from human activities, by the storage of carbon (i.e. in carbon reservoirs on land or in the ocean).

- Electricity generation: will require a significant expansion of low carbon generation; this includes low cost renewables, with more flexible demand and storage.

9.15 Increasing the renewables penetration in the UK electricity mix to 80% by 2050 will largely be met with intermittent, non-dispatchable[5] generation types. The CCC suggest that on average, 3 GW per year of solar generation will need to be installed to reach renewable supply targets.

9.16 The Net Zero Strategy: Build Back Greener (HM Government, 2021) sets out the UK's plans to achieve net zero emissions by 2050. Alongside this target is the ambition to fully decarbonise the UK's power system by 2035 through growth in renewable and nuclear power.

9.17 Further to this, Net Zero Wales (NZW) plan sets the ambition to increase renewable energy capacity by an additional 1 GW by 2025 in order to progress towards a decarbonised energy system.

9.18 The Smart Systems and Flexibility Plan (Department for Business, Energy and Industrial Strategy (BEIS), 2021a) sets out how the energy system can increase flexibility to facilitate the increase of intermittent non-dispatchable energy generation. This includes increased BESS capacity, with an anticipated 13 GW demand for low-carbon energy storage by 2030.

9.19 The main guidance used for the assessment of GHG emissions in EIA is the Institute of Environmental Management and Assessment (IEMA) guide 'Assessing Greenhouse Gas Emissions and Evaluating their Significance' (IEMA, 2022).

9.20 The main guidance document with regard to climate risk and resilience assessment within the context of EIA is the Environmental Impact Assessment Guide to: Climate Change Resilience & Adaptation (IEMA, 2020).

9.21 Additional guidance used for the quantification of GHG emissions includes:

- the Greenhouse Gas Protocol suite of documents (World Resources Institute (WRI) and World Business Council for Sustainable Development (WBCSD), 2004);
- Valuation of Energy Use and Greenhouse Gas: Supplementary guidance to the HM Treasury Green Book (Department for Energy Security and Net Zero (DESNZ) and Department for Business, Energy and Industrial Strategy (BEIS), 2022); and
- UK Government GHG Conversion Factors for Company Reporting (DESNZ and Department for Environment Food and Rural Affairs (Defra), 2023).

GHG Emissions Calculations – Overview and Assessment Boundary

9.22 In overview, GHG emissions have been estimated by applying published emissions factors to activities in the baseline and to those required for the Proposed Development. The emissions factors relate to a given level of activity, or amount of fuel, energy or materials used, to the mass of GHGs released as a consequence.

[5] Non-dispatchable sources of electricity generate electrical energy but cannot be turned on or off in order to meet fluctuating demand. The two main types of non-dispatchable sources are solar power and wind power.

9.23 The GHGs considered in this assessment are those in the 'Kyoto basket[6]' of global warming gases expressed as their CO_2-equivalent (CO_2e) global warming potential (GWP). This is denoted by CO_2e units in emissions factors and calculation results. GWPs used are typically the 100-year factors in the Intergovernmental Panel on Climate Change Fourth Assessment Report (Forster *et al,* 2007) or as otherwise defined for national reporting under the United Nations Framework Convention on Climate Change (UNFCCC).

9.24 GHG emissions caused by an activity are often categorised into 'scope 1', 'scope 2' or 'scope 3' emissions, following the guidance of the WRI and the WBCSD Greenhouse Gas Protocol suite of guidance documents (WRI and WBSCD, 2004).

- Scope 1 emissions: released directly by the entity being assessed, e.g. from combustion of fuel at an installation;
- Scope 2 emissions: caused indirectly by consumption of imported energy, e.g. from generating electricity supplied through the national grid to an installation; and
- Scope 3 emissions: caused indirectly in the wider supply chain, e.g. in the upstream extraction, processing and transport of materials consumed or the downstream disposal of waste products from an installation.

9.25 This assessment has sought to include emissions from all three scopes, where this is material and reasonably possible from the information and emissions factors available, to capture the impacts attributable most completely to the Proposed Development.

9.26 Scope 3 emissions resulting from the manufacturing and construction of the solar panels, BESS and associated balance of system (BoS)[7] components have been calculated via published benchmark carbon intensities and published lifecycle analysis (LCA) literature regarding photovoltaic (PV) panels and BESS technology.

9.27 The assessment has considered (a) the GHG emissions arising from the Proposed Development, (b) any GHG emissions that it displaces or avoids, compared to the current or future baseline, and hence (c) the net impact on climate change due to these changes in GHG emissions overall.

9.28 The majority of the construction-stage GHG emissions associated with the manufacturing of components are likely to occur outside the territorial boundary of the UK and hence outside the scope of the UK's national carbon budget. However, in recognition of the climate change effect of GHG emissions (wherever occurring) and the need, as identified in national policy, to avoid 'carbon leakage' overseas when reducing UK emissions, the full life-cycle GHG emissions of the Proposed Development, including construction-stage emissions, have been evaluated where possible when determining the significance of effects.

Climate Risks – Overview

9.29 Potential climatic conditions in the 2040-2069 and 2070-2099 time periods at the site have been considered based on the Met Office Hadley Centre (MOHC) 'UKCP18' probabilistic projections (MOHC, 2021). Projections for the global emissions representative concentration pathway (RCP)

[6] The 'Kyoto Basket' encompasses the following greenhouse gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons, perfluorocarbons and sulphur hexafloride (SF_6).

[7] BoS components are predominantly comprised of inverters, electrical cabling and frames/mounting structures.

8.5 have been used as a worst-case approach, as this is a high-emissions scenario assuming 'business as usual' growth globally with little additional mitigation to combat climate change.

9.30 Further detail of the approach and data input is given in **Appendix 9.2**: Climate Risk.

9.31 A high-level screening risk assessment has been undertaken, considering the hazard, potential severity of impact on the Proposed Development and its users, probability of that impact, and level of influence the Proposed Development design can have on the risk.

9.32 Where potentially significant risks have been identified at the screening stage, further assessment has been undertaken with consideration of mitigation to determine whether significant residual risks are likely.

9.33 The assessment of flood risk, including increases in rainfall rates due to climate change, is provided in Chapter 8: Hydrology and Flood Risk.

Study Area

9.34 GHG emissions have a global effect rather than directly affecting any specific local receptor. The impact of GHG emissions occurring due to the Proposed Development on the global atmospheric concentration of the relevant GHGs, expressed in CO_2-equivalents (CO_2e), is therefore considered within this assessment.

9.35 The climate change risk study area is the climate projections 25 km grid cell in which the site is located, given such future projected climate change within this area may have potential to affect the Proposed Development.

Baseline Methodology

9.36 Published benchmarks have been used to establish the baseline of current and future grid average carbon intensity. The climatic baseline is that of existing weather patterns as likely to be modified by climatic trends during the development's lifetime.

9.37 Baseline information has been gathered primarily from the following sources:

- DESNZ and BEIS (2023) Valuation of Energy Use and Greenhouse Gas: Supplementary guidance to the HM Treasury Green Book.
- DESNZ and Defra (2023) UK Government GHG Conversion Factors for Company Reporting.
- MOHC (2022) UK Climate Projections User Interface v2.7.0.

9.38 Representative project examples have also been used to establish the baseline of current and future carbon intensity of peaking plants. Baseline information for this have been informed via the following sources:

- Thurrock Flexible Generation Plant. Environmental Statement Volume 6. Appendix 14.1: GHG Calculations. Prepared for Thurrock Power (RPS, 2020).
- VPI Immingham OCGT. Environmental Statement: Volume I. Chapter 15: Sustainability and Climate Change. Document ref. 6.2.15 (VPI Immigration, 2019).

Consultation

9.39 The December 2020 Scoping Direction issued by PEDW identified climate change as an item to be scoped in to the EIA. No further comments were made by the PEDW on this topic, and no comments were made by consultees at scoping stage, save with respect to the inclusion of climate change allowances in the flood risk assessment.

Assessment Criteria and Assignment of Significance

Receptor Sensitivity/Value

9.40 GHG emissions have a global effect rather than directly affecting any specific local receptor to which a level of sensitivity can be assigned. The global atmospheric mass of the relevant GHGs and consequent warming potential, expressed in tCO_2e, has therefore been treated as a single receptor of **high sensitivity** (given the importance of the global climate as a receptor).

Magnitude of Impact

9.41 As GHG emissions can be quantified directly and expressed based on their GWP as tonnes of CO_2e emitted, the magnitude of impact is reported numerically.

9.42 The magnitude of potential impacts to the development from a changing climate is reported using scoring of 1–3 for descriptive categories of severity, probability and influence of potential impacts. Definitions for scoring can be found below in **Table 9.1**. Further information is set out in **Appendix 9.2**.

Table 9.1: Severity, Probability and Influence Factor Definitions

Factor	Score definitions
Severity: the magnitude and likely consequences of the impact should it occur.	**1 =** unlikely or low impact.
	2 = moderate impacts
	3 = severe impact
Probability: reflects both the range of possibility of climatic parameter changes and the probability that the possible changes would cause the impact considered	**1 =** unlikely or low probability of impact
	2 = moderate probability of impact
	3 = high probability of impact
Influence: the degree to which design of the Proposed Development can affect the severity or probability of impacts	**1 =** no or minimal potential to influence
	2 = moderate potential to influence
	3 = strong potential to influence

Significance of Effects

9.43 Assessment guidance for GHG emissions (IEMA, 2022) describes five levels of significance for emissions resulting from a development, each based on whether the GHG emission impact of the development will support or undermine a science-based 1.5°C compatible trajectory towards net zero. To aid in considering whether effects are significant, the guidance recommends that GHG emissions should be contextualised against pre-determined carbon budgets, or applicable existing and emerging policy and performance standards where a budget is not available. It is a matter of professional judgement to integrate these sources of evidence and evaluate them in the context of significance.

9.44 Taking the guidance into account, the following have been considered in contextualising the Proposed Development's GHG emissions:

- The magnitude of gross and net GHG emissions as a percentage of national and local carbon budgets (where feasible);
- The GHG emissions intensity of the Proposed Development against current baseline emissions intensity for such energy generation and projections or policy goals for future changes in that baseline; and
- Whether the Proposed Development contributes to, and is in line with, the UK's policy for GHG emissions reductions, where these are consistent with science-based commitments

to limit global climate change to an internationally-agreed level (as determined by the UK's NDC to the Paris Agreement (HM Government, 2020)).

9.45 Effects from GHG emissions are described in this chapter as adverse, negligible or beneficial based on the following definitions, which closely follow the examples in Box 3 of the IEMA guidance (IEMA, 2022).

- **Major Adverse:** the Proposed Development's GHG impacts would not be compatible with the UK's net zero trajectory. Its GHG impacts would not be mitigated, or would be compliant only with do-minimum standards set through regulation. The Proposed Development may not provide further emissions reductions required by existing local and national policy for developments of this type.

- **Moderate Adverse:** the Proposed Development's GHG impacts would not be fully compatible with the UK's net zero trajectory. Its GHG impacts would be partially mitigated and may partially meet the applicable existing and emerging policy requirements, however it would not fully contribute to decarbonisation in line with local and national policy goals for development's of this type.

- **Minor Adverse:** the Proposed Development's GHG impacts would be compatible with the UK's 1.5°C trajectory and would comply with up-to-date policy and 'good practice' emissions reduction measures. The Proposed Development would fully comply with measures necessary to achieve the UK's net zero trajectory.

- **Negligible:** the Proposed Development would achieve emissions mitigation that goes substantially beyond existing and emerging policy compatible with the 1.5°C trajectory, helping to achieve this rate of decarbonisation sooner, and would have minimal residual net emissions. The Proposed Development would provide exemplary design and performance standards with respect to GHG emissions for developments of this type.

- **Beneficial:** the Proposed Development would result in emissions reductions from the atmosphere, whether directly or indirectly, compared to the without-Proposed Development basline. As such, its net GHG emissions would be below zero. The Proposed Development would substantially exceed net zero requirements.

9.46 Major and moderate adverse effects and beneficial effects are considered to be significant. Minor adverse and negligible effects are not considered to be significant.

9.47 In accordance with IEMA's 2020 guidance for climate change risk and resilience or adaptation measures, a risk assessment has been undertaken, considering the hazard, potential severity of impact on the Proposed Development and its users (including their sensitivity and vulnerability), probability of that impact, and level of influence the Proposed Development design can have on the risk. The approach to this risk assessment is detailed in **Appendix 9.2:** Climate Risk. A risk score of five or more (the minimum score where more than one element of the risk assessment score is above 'low') has been defined as a risk that could lead to a significant effect. By considering the good practice design measures incorporated into the Proposed Development, professional judgement is used in determining whether impacts are likely to result in significant adverse or beneficial effects.

Limitations of the Assessment

9.48 There is uncertainty about future climate and energy policy and market responses, which affect the likely future carbon intensity of energy supplies, and thereby the future carbon intensity of the electricity generation being displaced by the Proposed Development. Government projections

consistent with national carbon budget commitments have been used in the assessment, alongside the current grid average.

9.49 The use of the current grid average and residual grid mix as a benchmark against which operational benefits are compared may overestimate the operational benefits of the Proposed Development, as both the current grid average and residual grid mix are a static figures that do not represent the likely scenario of an increasingly decarbonised grid over the Proposed Development's 40-year operational lifetime. However, comparison with predicted marginal carbon intensity reductions over time (DESNZ and BEIS, 2023) is likely to underestimate the operational benefits of the Proposed Development, as these marginal predictions account for all future energy installation in line with current policy, including that of the Proposed Development.

9.50 Therefore, a range in estimated avoided emissions resultant from the Proposed Development has been provided, accounting for all three of the above-mentioned emissions factors. Avoided emissions over the Proposed Development's lifetime are likely to fall within this range.

9.51 Due to the early stage of development design, limited information is available regarding the particular solar panel technology type being used at the Proposed Development. As such, a range of Environmental Product Declarations (EPDs) for solar modules frequently procured by the Applicant have been used to inform the estimates of embodied carbon. It has been assumed that the Applicant will procure panels for the Proposed Development from module suppliers and for module types consistent with those procured previously, and therefore in line with EPDs used for the assessment.

9.52 EPDs detailed life cycle emissions for crystalline silicon (c-Si) and thin-film cadmium telluride (CdTe) panel technology. Life cycle emissions associated with each EPD were averaged according to their panel type. Given c-Si panels are more carbon intensive than thin film panels, the assessment of construction phase emissions has been informed by the average of c-Si panel carbon intensities to provide a conservative worst-case assessment. Should the Applicant procure thin film panels, or cSi panels with a carbon intensity below the average used for such panel type, construction-stage emissions from the Proposed Development can be expected to be reduced in comparison to those reported.

9.53 The specific BESS technology that would be used by the Proposed Development has not yet been specified. Further, new battery technologies may be available by the time the BESS elements of the Proposed Development are constructed. Thus, there is a degree of uncertainty regarding the construction-stage GHG emissions resulting from the manufacturing of the BESS. Given that over 60% of stationary lithium-ion batteries are nickel-manganese-cobalt (NMC) batteries (IEA, 2020b), this is the technology that has been assumed in this assessment as it represents the majority of the market share for this development type. Moreover, the most energy intensive process of lithium-ion battery manufacturing has been identified as the energy demand of the dry room (Dai *et al*, 2019), which would be a consistent factor across many different lithium-ion battery technology manufacturing processes.

9.54 The carbon intensity of lithium-ion battery manufacturing can vary depending on the carbon intensity of the electricity grid at the point of production. In order to account for such uncertainty a range of construction-stage GHG impacts has been stated.

9.55 While A1-A5 life cycle stages are covered in the assessment of the Proposed Development's solar array element, due to available data, only A1-A3 life cycle stages have been assessed for the BESS component of the development.

9.56 The BESS are likely operational by 2033 at the latest. As such, all estimates of emissions resulting from the Proposed Development assume the BESS' first year of operation in 2033, to present a conservative assessment of avoided emissions during the Proposed Development's operational

lifetime. Should the BESS be constructed earlier and become operational before 2033, it is anticipated that avoided emissions from the operational phase would be increased in comparison to those reported within this assessment.

9.57 When assessing climate risks, uncertainty arises from both modelling uncertainty and natural variability in the potential magnitude of future changes in climate. Therefore, a high magnitude of change scenario and the high end of probabilistic projections have been used, to provide a precautionary worst-case approach. This is further discussed in **Appendix 9.2**: Climate Risk.

9.58 The above uncertainties are integral to the assessment of climate change effects but a precautionary approach has been taken as far as practicable to provide a reasonable worst case assessment. On the basis of the above, it is considered that limitations to the assessment have been minimised and that the results provide a sufficiently robust estimate of the impacts of the Proposed Development to identify significant effects.

Baseline Environment

9.59 With regard to current climate, the baseline is the local and regional climate and resulting weather patterns recorded in Met Office data. This is in the context, however, of wider trends in global climate changes affecting the UK climate, which at their present rates may be considered part of the known baseline. The change in baseline over time with climate change is set out in **Appendix 9.2**.

9.60 With regard to GHG emissions, the current baseline is agricultural land with previous industrial use. The site contains sand and gravel deposits, with shallow coal resources underlying the majority of the site. There is no indication of peat soils being present.

9.61 With regard to the electricity export of the Proposed Development, the baseline is the current average grid electricity carbon intensity. This value has been taken from published benchmarks (DESNZ and Defra, 2023) and equals 0.252974 $kgCO_2e/kWh$ (totalling the intensity of electricity generated, and emissions associated with the upstream extraction, refining and transportation of fuels for electricity generation prior to combustion). Also used is the residual energy mix carbon intensity (0.365 $kgCO_2e/kWh$) (AIB, 2023) which represents the alternative marginal generation source displaced by the Proposed Development (i.e. the generator that would have been supplying the grid with electricity in the absence of the Proposed Development, powered by coal, oil or gas).

9.62 With regard to the electricity export from the BESS element of the Proposed Development, the current baseline is the carbon intensity of the grid during periods of low renewable energy supply and high demand. Without energy storage, the electricity demand during these periods would be met via peaking plants. The unabated carbon intensity of peaking plants has been calculated by taking an average of the calculated carbon intensity for two UK facilities employing different gas-fired peaking generation technologies (Immingham Open Cycle Gas-Turbine (VPI Immingham, 2019) and Thurrock Flexible Generation Plant (RPS, 2020). The mean carbon intensity for these two facilities is 0.540 tCO_2eMWh, and this is taken to be a baseline carbon intensity of peak demand electricity generation for 2018 (when calculations were undertaken, using contemporary GHG conversion factors). The baseline for 2033, the anticipated operational start date for the BESS elements of the Proposed Development, has been modelled to be 0.080 tCO_2e/MWh based on a linear reduction in carbon intensity in peaking plant power generation from the 2018 baseline to converge with BEIS projected grid average carbon intensity factors by 2035. This is consistent with recommendations to decarbonise electricity production laid out in the Sixth Carbon Budget (CCC, 2020) and policies within the Net Zero Strategy (HM Government, 2021) and the Net Zero Growth Plan (HM Government, 2023).

Future Baseline Conditions

9.63 The future baseline GHG emissions for existing land-use without the Proposed Development are expected to remain similar, with a decrease in agriculture-related emissions over time in line with the UK's national climate change policies.

9.64 The future baseline for electricity generation that would be displaced by the Proposed Development depends broadly on future energy and climate policy in the UK, and more specifically (with regard to day-to-day emissions) on the demand for operation of the Proposed Development compared to other generation sources available, influenced by commercial factors and National Grid's needs.

9.65 Under the UK's climate targets and ambitions, the power system is intended to be fully decarbonised by 2035. Projections of this decarbonisation are provided by BEIS (detailed within **Appendix 9.3**) and are subject to the successful implementation of renewable energy generation projects such as the Proposed Development. These projections provide a valuable indicator of the rate of necessary – and expected – progress in reducing the carbon intensity of electricity generation as context for the Proposed Development's performance over its lifetime. It will also be necessary for peaking plants to decarbonise[8] (if not displaced by alternatives such as BESS). Projections specific to the carbon intensity of peaking power generation (rather than grid average) are not available.

9.66 However, assessing the Proposed Development's impact against a decarbonisation scenario would be a conservative estimate of the GHGs displaced by the Proposed Development: Without projects such as the proposed solar farm and associated BESS, there would be little progression towards grid decarbonisation. The projections of grid decarbonisation account for future renewable energy installation in line with current policy (such as the Proposed Development itself, or other similar developments), and should not be accepted with complete certainty. Furthermore, BEIS grid average and marginal projections are for the operational carbon intensity of generation sources, not accounting for embodied carbon and the full life-cycle effects.

9.67 As such, the current grid average intensity figure of 0. 252974 $kgCO_2e/kWh$ (DESNZ and Defra, 2023) and residual energy mix intensity figure of 0.365 $kgCO_2e/kWh$ (AIB, 2022) will also be considered. It is a static figure that does not represent the likely scenario of an increasingly decarbonised grid over the Proposed Development's 40-year estimated operational lifespan.

9.68 It is likely that the true value of avoided emissions as a result of the Proposed Development will fall somewhere within this range. The current grid average and residual energy mix represent scenarios that lack future renewable energy deployment to the UK national grid, while the long run marginal accounts for future renewable energy installation, in line with current policy. Therefore, the current grid average, residual energy mix and long run marginal projections will be used to provide a range of values for the current baseline and future business-as-usual baseline against which the benefits of the Proposed Development will be calculated.

9.69 To be conservative in not overstating the benefits of displacing peaking plant generation with the Proposed Development's BESS capacity, it has been assumed that the carbon intensity of peaking plants will be reduced over time and will be equal to the grid-average projection by 2035 onwards. A simple linear reduction in the carbon intensity of peaking plants form present-day values to

[8] It is expected that decarbonisation of gas fired peaking plants will be achieved via the implementation of carbon capture and storage (CCS) and by switching to alternative fuels such as hydrogen and biogas.

converge with the BEIS projected factors by 2035 has been calculated (as described in paragraph 9.62). Further detail regarding the carbon intensity of peaking plants can be found in **Appendix 9.3**.

Mitigation Measures Adopted as Part of the Proposed Development

9.70 As a renewable energy development, climate change mitigation is an inherent aim of the Proposed Development. The primary purpose of the Proposed Development is to facilitate the generation, storage and deployment of greater amounts of renewable energy capacity, bridging the gap between fluctuations in supply and demand, and hence minimising reliance on high carbon intensity power generation. This is considered in the assessment of operational effects included within this Chapter.

9.71 In order to ensure maximum energy yield, and therefore maximum GHG emissions displacement, the solar array would be south facing, and rows of panels would be distanced between 3 and 6 m apart from one another so as to avoid inter-panel shading.

9.72 The Applicant has achieved greater transparency into the GHG impacts of products being specified for the Proposed Development by obtaining EPDs from manufacturers, each detailing life cycle emissions associated with each product. Such life cycle emissions for modules are greatly reduced compared to available benchmark values obtained from a meta analysis of over 397 LCAs. Module suppliers chosen by the Applicant have each sought to improve the sustainability of their operations, with a focus on sustainable procurement within their supply chains and emission reductions in their operations. As such, the Applicant has ensured that emissions associated with the solar array during the construction phase have been reduced where possible.

9.73 Good working practices during the construction of the Proposed Development are being defined through an Outline Construction Environmental Management Plan (oCEMP). The oCEMP is included at **Appendix 2.2.** Where practicable, construction activities generating GHG emissions will be undertaken efficiently in order to reduce emissions in the following ways.

- where practicable, pre-fabricated elements would be delivered to the site ready for assembly, which will reduce on-site construction waste and reduce vehicle movements as part of the construction process;
- construction materials should be sourced locally where practicable, to reduce the impact of transportation;
- vehicles used in road deliveries of materials, equipment and waste arisings on- and off-site would be loaded to full capacity to minimise the number of journeys associated with the transport of these items;
- all staff members will be encouraged to car share where practicable and to arrive on-site prior to the AM network peak hour.
- all machinery and plant would be procured to adhere with emissions standards prevailing at the time and should be maintained in good repair to remain fuel efficient;
- when not in use, vehicles and plant machinery involved in site operations would be switched off to further reduce fuel consumption;
- where practicable, local waste management facilities would be used to dispose of all waste arisings, to reduce distant travelled and associated emissions;

- the volume of waste generated would be minimised, and resource efficiency maximised, by applying the principles of the waste hierarchy throughout the construction period. Segregated waste storage should be employed to maximise recycling potential for materials; and

- equipment and machinery requiring electricity would only be switched on when required for use. Procedures should be implemented so that staff adhere to good energy management practices, e.g. through turning off lights, computers and heating/air conditioning units when leaving buildings.

Assessment of Construction Effects

Assessment of Effects as a Result of Climate Change

9.74 Due to the relatively short construction programme (12-18 months) variations in climatic parameters would be minimal compared to the present-day baseline. Construction of the BESS will take approximately 6-9 months (independent of the overall construction programme). The BESS element of the Proposed Development will be constructed at a later date and is expected to be constructed during 2032 and will be completed by 2033 at the latest. Construction work practices are adapted to existing climate conditions and weather in the UK. **Appendix 9.2** summarises potential changes in climatic parameters further into the future. These changes are likely to occur gradually, and it is considered that construction contractors will be able to adapt working methods over time if necessary, should the development be built in later phases. For example, warmer winter conditions may extend the time certain construction activities, such as concrete pouring, can be carried out. A greater change of summer heatwave conditions may require adaptations, such as shading work areas or increased attention to construction dust control measures.

9.75 In line with the methodology detailed in paragraph 9.47 and **Table 9.1**, short term **negligible** impacts and **no significant** construction-stage effects are predicted as a result of climate change.

Assessment of Effects on Climate Change

Magnitude of Impact

9.76 The manufacturing and installation of both PV array and BESS would result in both direct and indirect GHG emissions at all stages of the Proposed Development's lifecycle.

9.77 The majority of the construction-stage impacts are 'Scope 3' (supply chain) emissions resulting from the extraction of raw materials and manufacturing of the PV cells, BESS, inverters, transformers and other BoS components.

9.78 Additional elements of the Proposed Development that are not included within the emissions totals include elements of site infrastructure (such as any surfacing or equipment housing). In comparison with the magnitude of emissions associated with the PV cells, BESS and BoS components, it is estimated that emissions associated with the site infrastructure would make a non-material contribution to the construction stage total. As such these have not been assessed in further detail. Additional detailed information concerning magnitude of impact can be found in **Appendix 9.3:** GHG calculations.

Solar PV

9.79 Solar PV LCAs are complex, given the large number of materials and processes involved in the production of PV modules and BoS components. Furthermore, the associated GHG emissions are

dependent on the location (and associated energy mix) of where these processes are occurring. As such a detailed LCA is beyond the scope of this assessment. Instead, a robust approach has been formulated by considering a range of Environmental Product Declarations (EPDs) for solar modules the Applicant commonly procures, thereby accounting for the likely range of magnitude of the Proposed Development's construction-stage GHG emissions.

9.80 A total of 15 solar module EPDs were used, detailing life cycle emissions associated with two types of PV panel (mono crystalline silicon (c-Si) and thin film cadmium telluride (CdTe)). EPDs were grouped by panel type, with resultant emissions intensities averaged accordingly. To provide a conservative assessment, the mono c-Si panels were selected for use within the calculation of construction-stage emissions as emissions associated with these panels are greater than those resulting from the thin film CdTe panels.

9.81 Construction stage emissions associated with the PV array were calculated by scaling the proposed solar capacity (for this assessment an 80 MWp capacity assumption was used) by the emissions intensities listed in **Table 9.2**, to total 43,521 tCO_2e.

Table 9.2: Construction stage GHG emissions of solar array

	Emissions intensity (tCO_2e/MWp)	Embodied carbon (tCO_2e/MWp)
Mono c-Si panels	654,57	43,521
Thin film CdTe panels	375,17	30,374

Battery Energy Storage Systems

9.82 Given their charge capability, energy density, round-trip efficiency and falling costs, lithium-ion batteries (LIB) are the most commonly employed battery for stationary applications. As such, this is the technology type being considered within this assessment.

9.83 The carbon intensity of the production of LIBs used for the purposes of this assessment has been informed by a study undertaken by the Swedish Environmental Research Institute (Emilsson and Dahllöf, 2019). BESS manufacture is an energy-intensive process, where energy can be sourced from a renewables-rich mix or fossil fuel-rich mix. Given that it is not known what energy-mix may be used, a range of carbon intensities was applied to account for this uncertainty.

9.84 At this stage in the Proposed Development design the total storage capacity of the BESS has not been finalised. The total output capacity will fall between 50 MW and 57 MW, and the discharge time will lie between 2 and 6 hours. As such, embodied carbon associated with the lowest (50 MW over 2 hours) and highest (57 MW over 6 hours) storage capacities have been calculated and reported within **Table 9.3.**

9.85 In both cases, it is anticipated that the BESS would have an expected lifetime of 5,000 discharge cycles (IEA, 2020c). Therefore, over the assessment period (indicatively 33 years from the point of construction), and assuming one full cycle per day, the BESS would have to be replaced circa 3 times. This has been accounted for in the embodied carbon values in **Table 9.3**. To be conservative, present-day values have been used for the carbon intensity of BESS production even for future replacements.

9.86 **Table 9.3** displays the benchmark carbon intensities that have been used in assessing the magnitude of impact of the GHG emissions from the production of the BESS being used in the Proposed Development.

Table 9.3: Construction-stage GHG intensity and impact of BESS

	Lower limit	Mid-point	Upper limit
Option a:			
Output capacity (MW)	50	50	50
Discharge Time (hrs)	2	2	2
Total storage capacity (MWh)	100	100	100
Number of BESS replacements for Proposed Development assumed lifetime	3	3	3
Carbon intensity of BESS manufacturing (tCO_2e/MWh BESS capacity)	61	84	106
BESS embodied carbon (tCO_2e)	**14,695**	**20,115**	**25,535**
Option b:			
Output capacity (MW)	57	57	57
Discharge Time (hrs)	6	6	6
Total storage capacity (MWh)	342	342	342
Number of BESS replacements for Proposed Development assumed lifetime	3	3	3
Carbon intensity of BESS manufacturing (tCO_2e/MWh BESS capacity)	61	84	106
BESS embodied carbon (tCO_2e)	**50,257**	**68,794**	**87,331**

Substation (including busbars and BoS components)

9.87 There is limited design data and few published LCAs from which to calculate the embodied emissions associated with the substation, busbars and BoS components. Data from an environmental product declaration (EPD) for a 16 kVA – 1000 MVA transformer (ABB, 2003) has therefore been used to provide an approximation of the potential order of magnitude of emissions, as transformers are among the major substation plant components and have a relatively high materials and carbon intensity, including the copper or aluminium winding.

9.88 The LCA listed a manufacturing GWP of 2,190 $kgCO_2e$ per MW. This was scaled by the Proposed Development output capacity of 57 MW to give an estimated embodied emission value of 125 tCO_2e. This value includes lifecycle stages A1-A3.

Total Construction-stage GHG impacts

9.89 The total range of construction stage impacts are shown in **Table 9.4** and have used the median embodied carbon figure for the BESS (to account for the likely energy intensity associated with the cell manufacture and assembly process), combined alongside the embodied carbon associated with the construction of the solar array and substation, to give a total figure for the Proposed Development's construction-stage GHG impacts.

Table 9.4: Total Construction-stage GHG emissions

System	Magnitude of Impact (tCO_2e)
Solar Array	43,521
BESS	20,115 to 68,794*
Substation	175
Total	**63,811 to 112,490**

*Median values for both the 100 MWh and 342 MWh battery storage options reported.

9.90 39% to 68% of construction-stage GHG impacts arise from the construction of the solar array, with approximately 61% to 32% of impacts arising from BESS construction, depending on the BESS storage option. The construction of other components makes an immaterial impact on the total construction effects, contributing less than 0.3% of the total GHG impact.

Sensitivity of Receptor

9.91 GHG emissions have a global effect rather than directly affecting any specific local receptor to which a level of sensitivity can be assigned. The global atmospheric mass of the relevant GHGs and consequent warming potential, expressed in CO_2-equivalents, has therefore been treated as a single receptor of **high sensitivity** (given the severe consequence of global climate change and the cumulative contributions of all GHG emissions sources).

Significance of Effect

9.92 As stated in paragraph 9.28, the majority of construction-stage emissions are likely to occur from the PV cell and BESS supply chain outside the territorial scope of the UK's national carbon budget, so it is not meaningful to contextualise emissions within this budget in order to assess their significance. However, carbon leakage (offshoring of emissions) has been identified as a risk in the UK's Net Zero Strategy (HM Government, 2021, page 122) and in advice published by the Committee on Climate Change (2020) with regard to industrial decarbonisation.

9.93 As GHG impacts are global, regardless of where the release point is geographically located, for the purpose of EIA the GHG impacts of the Proposed Development are assessed against the significance criteria in UK guidance and goals for emission reduction, despite occurring outside the UK's territory.

9.94 Considering the potential magnitude of GHG emissions set out in **Table 9.4** and mitigation measures adopted as part of the Proposed Development, based on the definitions in paragraphs 9.45 and 9.46 the magnitude of impact on the **high sensitivity** receptor would result in **not significant minor adverse** construction-stage effect.

9.95 However, as the purpose of the Proposed Development is to provide a source of renewable energy, the construction-stage effects must be considered together with the long-term operational effect to determine the overall lifetime effect of the Proposed Development. This is set out in the following sections.

Further Mitigation

9.96 Construction-stage GHG impacts could be further mitigated through continued sustainable procurement practices and close engagement with the supply chain, so that any products used in the construction of the Proposed Development are manufactured in conditions with reduced GHG impacts (e.g. via the use of renewable energy and efficient resource consumption).

9.97 Similarly, to the procurement of product EPDs for the solar modules, the Applicant should seek to obtain product EPDs for BESS systems from manufacturers; this can be used to support procurement decisions for lower-carbon producers and/or for further engagement with suppliers.

Residual Effect

9.98 With implementation of the proposed mitigation measures during detailed design, the Proposed Development's construction-stage climate change impacts – through direct and indirect greenhouse gas emissions – have the potential to be reduced compared to a typical business-as-usual approach. There is therefore the potential for the Proposed Development's construction-stage climate change impacts to be reduced to a minor adverse effect, which is not significant.

9.99 Despite further mitigation, it is unlikely that residual emissions from the PV cells and BESS supply chain can be fully avoided. As set out above, these emissions need to be considered in the context of the beneficial long-term effects of the Proposed Development, set out below.

Future Monitoring

9.100 No future monitoring of construction phase GHG emissions is considered to be required.

Accidents and/or Disasters

9.101 It not considered likely that there will be any GHG-related construction-stage accidents and/or disasters, nor that there will be any construction-stage accidents and/or disasters that would cause significant GHG emissions.

Assessment of Operational Effects

Assessment of Effects as a Result of Climate Change

Sensitivity of the Receptor

9.102 As detailed within **Appendix 9.2** the severity of effect score for each identified risk considers the potential consequences of the hazard and the sensitivity of the receptor(s) affected. Given the variability in the nature of the potential impacts of climate change on the development, receptors have been identified on a risk-specific basis, whereby all receptors relate to the continued safe and

effective operation of the Proposed Development. In line with IEMA (2020) guidance, the receptor vulnerability and susceptibility have been considered in determining the severity of risk. Four risks have been identified to impose a moderate severity of impact, while two risks have been identified to impose a low severity of impact. Sensitivity is detailed for each identified risk within **Appendix 9.2.**

Magnitude of Impact

9.103 The magnitude is the degree of a change from the relevant baseline conditions which derives from the operation of the Proposed Development. The magnitude has been expressed in **Appendix 9.2** as a combination of probability, which has been informed by potential climatic changes from the UKCP18 probabilistic dataset, and degree of influence for each identified risk.

Significance of Effect

9.104 **Appendix 9.2** summarises the potential climatic changes in the coming decades and considers the potential consequences for the Proposed Development in a risk assessment format. The most significant risk from climate change to the Proposed Development is likely to arise from flooding. This is assessed in detail in Chapter 8: Hydrology and Flood Risk and appropriate flood management and resilience measures have been provided, including an allowance for climate change effects.

9.105 The risk assessment in **Appendix 9.2** considers in its scoring the level of influence the design, construction and operation of the Proposed Development can have upon the risks, in addition to its severity and probability. Those risks over which the developer has little or no influence are therefore typically not considered significant effects of the Proposed Development, save where the severity and/or probability are highest.

9.106 With the exception of flood risk, the greatest risks to the Proposed Development due to climate change have been identified as those arising from high temperatures affecting operation of the battery storage element of the Proposed Development, as well as storms affecting power transmission and causing building damage.

9.107 With regard to the Proposed Development's solar array, projections of future cloud cover change may result in beneficial impacts, with increased output from the solar farm over its lifetime as cloud cover decreases.

9.108 Overall, the risk assessment identified three out of the seven assessed effects as potentially significant (as defined in paragraph 9.47) prior to resilience or adaptation measures to mitigate the risks. These were: structural damage to panel surfaces and other site infrastructure as a result of extreme weather events; extreme high temperatures and increased ambient temperatures leading to battery efficiency losses; and shrinking and swelling of soils due to excessive rainfall and drought leading to subsidence. Given these significant effects will be mitigated through the incorporation of embedded good practice design measures, the effect on the Proposed Development has been determined to be **negligible** and therefore not significant. Good practice design measures include the following:

- Compliance with Building Regulations Approved Document A: Structure (HM Government, 2013), for ensuring resilience to extreme weather events and ground movement.
- Adequate thermal design and ventilation system for the BESS.
- Statutory requirements for network operators keeping overhead power lines clear from vegetation, in order to minimise damages to transmission network (Dawson et al, 2016).

Assessment of Effects on Climate Change

Magnitude of Impact

9.109 The Proposed Development comprises both a PV array (first year of operation in 2026), generating renewable electricity, and a BESS which can store and then discharge power (first year of operation in 2033 latest). Both are connected to the electricity grid. The BESS capacity could potentially be used to store part of the PV array generation, releasing that power at peak times when it is most needed, or could store power from the grid.

9.110 It is expected that, as a renewables development co-located with BESS, the BESS element would aim to take advantage of both price/time shifting in order to accrue additional revenue from energy arbitrage and peak shaving, in order to avoid network curtailment or reinforcement costs. This would maximise both the environmental and economic benefit of the Proposed Development best matching the PV generation and storage/release of energy from the site to times of high and low electricity demand.

9.111 The business strategy for the BESS element of the Proposed Development therefore has implications for the quantification of the displaced emissions from both the PV array and the BESS itself. Two hypothetical scenarios (scenario 1 and scenario 2) have been developed to represent these options. It is likely that the Proposed Development's operations would, in reality, reflect a combination of both scenarios, and the avoided emissions are likely to therefore lie between those presented in either scenario.

9.112 As detailed in paragraph 9.84, the final storage capacity of the proposed BESS has not yet been determined, but it is known that it will have an output capacity that falls between 50 to 57 MW with a discharge time between 2 and 6 hours (both assuming one charge cycle per day). As such, both BESS options will be considered within each scenario:

a) BESS storage capacity of 100 MWh per day; and

b) BESS storage capacity of 342 MWh per day.

Scenario 1: BESS charged directly from the PV array

9.113 The BESS are charged directly from the PV array, and only draw power from the grid where their storage capacity exceeds that available to be provided by the PV array (only applicable under option b, where the BESS have a greater storage capacity).

9.114 Power provided by the PV array has no additional associated carbon intensity as the construction stage emissions have already been accounted for. However, it also reduces the direct grid export of the PV array: assuming one cycle of charging and discharge per day, the PV array export is reduced by 29,200 MWh per year when assessing option a (lower BESS storage capacity). When assessing option b (higher BESS storage capacity) 100% of the available solar output would be directed to the BESS and no electricity would be exported directly to the grid by the PV array.

9.115 Where the BESS storage capacity exceeds that able to be provided by the PV array (option b), the remaining power would be provided from the grid at low demand/price times (i.e. when there is excess renewable generation that would otherwise be curtailed), which is represented by wind power under this scenario. An emissions intensity of 0.99 gCO2e/kWh (due to the operation and maintenance carbon cost of wind power generation) is applied to such energy supply and attributed to the Proposed Development.

Scenario 2: BESS charged directly from UK grid electricity

9.116 The BESS operate independently of the PV array and are charged with grid power available at low demand/price times (i.e. when there is excess renewable generation that would otherwise be curtailed), which is represented by wind power under this scenario. As in scenario 1, an emissions intensity of 0.99 gCO2e/kWh (due to the operation and maintenance carbon cost of wind power generation) is applied to such energy supply and attributed to the Proposed Development. This value is taken from an average of wind LCA studies, more details of which can be found in **Appendix 9.3.**

9.117 As such, the entirety of the PV's operational energy output is exported directly to the grid in this scenario, regardless of the storage capacity of the BESS.

Summary

9.118 **Appendix 9.3** details the full calculations of avoided emissions associated with each of the above scenarios. In summary, the range in estimated avoided emissions over the operation of the Proposed Development, encompassing the outcome of all scenarios, totals -83,100 tCO_2e to -988,234 tCO_2e. Negative values represent avoided GHG emissions.

Sensitivity of Receptor

9.119 GHG emissions have a global effect rather than directly affecting any specific local receptor to which a level of sensitivity can be assigned. The global atmospheric mass of the relevant GHGs and consequent warming potential, expressed in CO_2-equivalents, has therefore been treated as a single receptor of **high sensitivity** (given the consequences of global climate change and the cumulative contributions of all GHG emissions sources).

Significance of Effect

9.120 The nature and significance of effect has been characterised as set out in paragraphs 9.44 and 9.45, by contextualising the Proposed Development's operational GHG impacts within the UK carbon budget, in comparison with the carbon intensity of electricity supply in the baseline, and with regard to its compliance with the UK's net zero trajectory, local and national climate-related policy, legislation and guidance.

Carbon Budgets

9.121 The Proposed Development's operational-stage emissions have been contextualised in the context of the UK's fourth, fifth and sixth carbon budgets. The Proposed Development GHG impacts given within **Table 9.5** and **Table 9.6** represent national and regional carbon budget expenditures respectively that would have occurred in the absence of the Proposed Development and have therefore been avoided. **Table 9.5** displays the UK national carbon budgets and how the Proposed Development's operational GHG impacts relate to them.

9.122 Cumulative avoided emissions have been projected to the end of the Sixth Carbon Budget and detailed within **Table 9.5.** The range in emissions presented displays the likely best and worst case avoided emissions across all scenarios, as calculated within **Appendix 9.3.**

9.123 Beyond the end of the Sixth Carbon Budget, it is likely that emissions associated with grid electricity generation from a variety of both baseload and peaking sources will have decreased as a result of decarbonisation strategies (as shown within BEIS projections of the carbon intensity of grid electricity). As such, there is anticipated to be little remaining difference between the carbon intensity of different generation sources, and avoided emissions resulting from the Proposed Development

which would, on that projection, become negligible beyond that point, which is a conservative scenario for the assessment of effects.

Table 9.5: GHG Impacts in the Context of the UK's Carbon Budgets

Time period	2023-2027	2028-2032	2033-2037	Total[9]
UK Carbon Budget (tCO2e)	1,950,000,000	1,730,000,000	960,000,000	**4,640,000,000**
Proposed Development GHG impacts tCO_2e)	-25,096 to -84,849	-35,482 to -133,797	-12,472 to -144,130	**-73,050 to -332,775**
Development avoided emissions as percentage of UK carbon budget (range)	-0.0013% to -0.0028%	-0.0021% to -0.0077%	-0.0013% to -0.0150%	**-0.0016% to -0.0072%**

9.124 Additionally, the Tyndall Centre for Climate Change Research (2022) has recommended district-specific carbon budgets up to 2100 that, in its research, are considered to be compatible with a 1.5°C aligned trajectory for the UK. The Proposed Development's operational GHG impacts were considered in terms of Wrexham's Tyndall Centre-derived carbon budget.

9.125 The Tyndall Centre carbon budgets are more stringent than the UK national budgets (as advised by the CCC); the carbon budget for Wrexham would result in achieving zero or near zero carbon by 2041[10]. The Tyndall Centre carbon budgets expressed below are for energy-related CO_2 emissions only.

9.126 **Table 9.6** displays the Wrexham-specific carbon budgets and how the Proposed Development's operational GHG impacts relate to them.

Table 9.6: GHG Impacts in the Context of the Wrexham Carbon Budgets

Time period	2023-2027	2028-2032	2033-2037	Total[11]
Wrexham Carbon Budget (tCO2e)	200,000	900,000	500,000	**3,400,000**
Proposed Development GHG impacts (tCO_2e)	-25,096 to -84,849	-35,482 to -133,797	-12,472 to -144,130	**-73,050 to -332,775**

[9] This is the total during the budget periods, not the total for the Proposed Development's assumed lifetime.

[10] The Tyndall Centre defines zero or near zero carbon as achieving CO_2 levels >96% lower than in the Paris Agreement reference year (2015)

[11] This is the total during the budget periods, not the total for the Proposed Development's assumed lifetime.

Time period	2023-2027	2028-2032	2033-2037	Total[11]
Development avoided emissions as percentage of UK carbon budget (range)	-1.3% to -2.7%	-3.9% to -14.9%	-2.5% to -28.8%	**-2.1% to -9.8%**

9.127 As can be seen from **Table 9.6**, when the current grid average, residual energy mix and long run marginal scenarios are considered, in terms of contextualising avoided emissions within the Wrexham carbon budgets, a saving somewhere within the range of 2.1% to 9.8% can be considered for the Proposed Development, encompassing the range associated with each likely scenario. These savings would occur through avoided emissions occurring as a result of the Proposed Development across the three Carbon Budget periods. This would provide a measurable contribution to avoiding potential Carbon Budget expenditure at the Wrexham Borough scale under both scenarios provided.

Climate Policy, Legislation and Guidance

9.128 The Proposed Development is in line with the NPPF's principle of supporting new renewable and low carbon energy developments, in addition to their associated infrastructure, in order to contribute to reductions in GHG emissions.

9.129 Further, the Proposed Development is supported by national energy and climate change policy (including the National Infrastructure Strategy, Sixth Carbon Budget, Net Zero Strategy, British Energy Security Strategy, and Net Zero Wales, detailed within **Appendix 9.1**) which highlight the need for an end to the use of unabated fossil fuel generation, whilst also significantly ramping up electricity generation capacity in order to meet the demands of increased electrification of transport, heat and industry. In addition, the p9olicies promote the decarbonisation of grid electricity and increase in its flexibility through the implementation of energy storage technologies. As such, government policy dictates that large-scale deployment of renewable energy generators such as the Proposed Development are necessary in order to meet GHG reduction targets.

9.130 By facilitating the expansion of renewable energy supply, the Proposed Development would assist the UK Government target of achieving a fully decarbonised power system by 2035, and both the UK and Welsh Government's aim to become net zero by 2050.

9.131 As a facilitator of the expansion of renewable energy generation, the Proposed Development is in line with UK-wide, and Wales-specific, planning policy and legislation as well as carbon and energy-related policy stated in Wrexham Unitary Development Plan (2005).

Effect

9.132 Using the definitions in paragraph 9.45 the impact of GHG emissions from the operational phase of the Proposed Development on the **high sensitivity** receptor would result in a **significant beneficial** effect.

9.133 This is on the basis that, during its operational period, the Proposed Development will not result in any GHG emissions (aside from negligible energy use during maintenance activities). The development will provide renewable energy, thereby enabling the continued decarbonisation of grid electricity and the displacement of higher-emitting energy sources, which is identified in both policy and expert guidance as essential to facilitate the UK's and Wales's 1.5°C-aligned trajectory towards net zero.

9.134 By reducing the need for electricity generation from existing sources with higher carbon intensity in the current and future business-as-usual baseline, the Proposed Development indirectly causes GHG emissions that would otherwise have occurred to be avoided.

9.135 As such it is considered to cause a net reduction in GHG emissions that would be released to the atmosphere compared to the baseline over its operating lifetime, which meets the definition of a significant beneficial effect.

Further Mitigation

9.136 No further operational-stage mitigation has been proposed.

Future Monitoring

9.137 No future monitoring of operational phase GHG emissions is considered to be required.

Accidents/Disasters

9.138 It is not considered likely that there will be any GHG-related operational-stage accidents and/or disasters, nor that there will be any operational-stage accidents and/or disasters that would cause significant GHG emissions.

Potential Changes to the Assessment as a Result of Climate Change

9.139 A climate risk assessment has been undertaken and detailed within **Appendix 9.2.** The most significant risk from climate change to the Proposed Development is likely to arise from flooding. This is assessed in detail in Chapter 8: Hydrology and Flood Risk.

9.140 The future changes to cloud cover as a result of climate change were considered. The total cloud anomaly from the UKCP18 probabilistic dataset averaged over both a 2040-2069 and 2070-2099 time period relative to a 1961-1990 baseline for the 25 km grid square in which the site is located is included within **Table 9.7,** below. Further details of the UKCP18 data can be found in **Appendix 9.2.**

Table 9.7: Future cloud cover change

Cloud cover change (%) for RCP8.5			
	10th Percentile	**Median**	**90th Percentile**
2040-2069	-6.86	-3.35	1.74
2070-2099	-11.85	-5.18	1.11

9.141 The total annual cloud cover has a direct relationship with the total annual solar insolation being received by the solar array, thereby effecting the total annual energy yield. As shown within **Table 9.7,** cloud cover is anticipated to decrease across this century. This has positive implications for increased energy generation and demonstrates that the Proposed Development's technology would be resilient to, and benefit from, potential climate change in this respect. An increase in annual yield

from the Proposed Development would increase avoided emissions and reduce the payback period, increasing the benefits seen from the Proposed Development.

Assessment of Decommissioning Effects

Assessment of Effects as a Result of Climate Change

9.142 Due to the likely short decommissioning programme variations in climatic parameters would be minimal compared to the present-day baseline. It is unlikely that there would be any significant climate change risks compared to the present-day baseline to occur during this phase. Decommissioning work practices are adapted to existing climate conditions and weather in the UK. **Appendix 9.2** summarises potential changes in climatic parameters further into the future. These changes are likely to occur gradually, and it is considered that contractors will be able to adapt working methods over time if necessary. For example, a greater change of summer heatwave conditions may require adaptations, such as shading work areas or increased attention to decommissioning dust control measures.

9.143 In line with the methodology detailed in paragraph 9.47 and **Table 9.1**, short term **negligible** impacts and **no significant** decommissioning-stage effects are predicted as a result of climate change.

Assessment of Effects on Climate Change

Magnitude of Impact

9.144 Emissions during this phase likely relate to the use of plant for the decommissioning, disassembly, transportation to a waste site, and ultimate disposal or recycling of the equipment and other site materials.

9.145 The majority of components of the Proposed Development are considered to be recyclable. This is the preferred solution when disposing of components, as this not only prevents the materials from being sent to landfills, but also reduces the need for the extraction of primary materials. Material which cannot be recycled might be used for incineration or energy from waste.

9.146 Given the lifetime of the Proposed Development, it is likely that material recycling will be advanced in comparison to today, and decarbonisation targets will reduce any emissions associated with plant and vehicle movements. As such, emissions associated with the disposal of materials at the end of their lifetime is considered immaterial and may even result in future avoided emissions. Associated emissions have not been considered further.

Sensitivity of Receptor

9.147 GHG emissions have a global effect rather than directly affecting any specific local receptor to which a level of sensitivity can be assigned. The global atmospheric mass of the relevant GHGs and consequent warming potential, expressed in CO_2-equivalents, has therefore been treated as a single receptor of **high sensitivity** (given the consequences of global climate change and the cumulative contributions of all GHG emissions sources).

Significance of Effect

9.148 Using the definitions in paragraph 9.45 the impact of GHG emissions from the decommissioning phase of the Proposed Development on the **high sensitivity** receptor would result in a **not significant negligible** effect.

Assessment of Whole-Life Effects

Significance of Effect

9.149 Regarding the solar element of the Proposed Development, consistent with the assessment of operational effects, the lifetime effects assessment is made on the basis that the Proposed Development would displace higher emitting energy sources that would have continued in the business-as-usual baseline. This has been calculated using current grid average carbon intensity of generation, in addition to the residual energy mix carbon intensity, treating both as remaining consistent in the future baseline without the Proposed Development.

9.150 To provide further sensitivity analysis, the lifetime effects assessment of the solar element of the development has also considered the effects within the context of grid decarbonisation. This has been assessed using the long run marginal carbon intensity of generation, which takes into account future grid decarbonisation resulting from increasing renewable energy infrastructure in line with UK policy.

9.151 With regard to BESS, consistent with the assessment of operational effects, this assessment assumes the Proposed Development would displace high-emission energy associated with gas-fired peaking plants and replace it with energy sourced from renewable technology. Two BESS options are considered, accounting for the range in proposed storage capacity.

9.152 Together, these scenarios provide an indicative range of net GHG effects using the baseline based on the current grid average and projected long run marginal carbon intensity.

9.153 The whole-life GHG emissions (total construction- and operational-stage emissions) resulting from the Proposed Development are estimated to lie between -906,612 tCO_2e and 24,641 tCO_2e. This range accounts for the scenarios described in the assessment of operational effects (including the proposed range in BESS capacity), and the sensitivity analysis as described above.

9.154 Notwithstanding the GHG emissions resulting from the construction stage of the development, the magnitude of avoided emissions resulting from the operational-stage of the development allows the Proposed Development to achieve net reduced emissions from its 3rd year of operation (carbon payback period) at the earliest.

9.155 Should the Proposed Development proceed with the solar element only (i.e. excluding the BESS installation), embodied carbon resulting from the development will be greatly reduced, operational avoided emissions will be slightly reduced, and an earlier carbon payback period will likely be achieved. The significance of effect would be consistent with what has been concluded within this Climate Change Chapter.

9.156 The above range in the estimated whole life GHG emissions represents both conservative and optimistic assessments of avoided emissions over the Proposed Development's lifetime, given the scenarios used to calculate operational avoided emissions (current grid average, residual energy mix and long run marginal carbon intensities).

9.157 It is important to highlight that such energy infrastructure is required to achieve such grid decarbonisation. The Proposed Development would provide an immediate contribution to the UK's ambition to increase solar generation capacity fivefold as set out in the Energy Security Strategy and increase flexibility of the grid through greater storage capacity.

9.158 **Table 9.8** presents the net emissions over the Proposed Development's lifetime in the context of the UK, Welsh and Wrexham Borough Carbon Budgets. The range of estimated net emissions (i.e. construction and operation) are reported as a percentage of the relevant carbon budgets.

9.159 Carbon Budgets that are relevant during both the construction and operational phase of the Proposed Development have been considered. Carbon Budgets stretching to the end of the UK's Sixth Carbon Budget have been incorporated for the UK and Wrexham Carbon Budgets, and up to 2030 for the Welsh Carbon Budget, as no further budgets have been published. Negative values represent avoided GHG emissions, effectively increasing the Carbon Budget, and positive values represent net GHG emission output.

Table 9.8: Net Emissions and Carbon Budgets

	Net Emissions
UK Carbon Budgets (2023-2037)	-0.0056% to 0.0008%
Welsh Carbon Budgets (2026-2030)	-0.0240% to 0.0207%
Wrexham Borough Carbon Budgets (2023 - 2037)	-7.5996% to 1.0768%

9.160 A carbon payback period can be achieved by 3 years (at the earliest, scenario dependent), providing net negative emissions compared to the business-as-usual baseline over its remaining operating period. This would be in line with the decarbonisation of electricity generation by 2035 as targeted in UK climate policy under the Sixth Carbon Budget. It would provide an immediate contribution to the UK's ambition to increase solar generation capacity fivefold as set out in the Energy Security Strategy and increase flexibility of the grid through greater storage capacity.

9.161 Using the definitions in paragraphs 9.44 and 9.45, the impact of whole-life GHG emissions from the Proposed Development on the **high sensitivity** receptor is considered to meet the definition of a **significant beneficial** effect over the course of its operating life.

Assessment of Cumulative Effects

9.162 All developments that emit GHGs have the potential to impact the atmospheric mass of GHGs as a receptor, and so may have a cumulative impact on climate change. Consequently, cumulative effects due to other specific local development projects are not predicted but are taken into account when considering the impact of the Proposed Development by defining the atmospheric mass of GHGs as a **high sensitivity** receptor. The operational phase **significant beneficial effect** of the assessment of the Proposed Development takes account of cumulative changes in GHG emissions from other generation sources.

Inter-relationships

9.163 The assessment of inter-related effects with climate change is provided in each topic chapter of this EIA Report. The main areas where there is a potential for inter-related effects, subject to assessment, are considered to be:

- Landscape and Visual – consideration of climate resilience (e.g. drought tolerance) in the design and species mix of landscape planting proposed;
- Ecology and Nature Conservation – potential changes in the sensitivity of habitats or species to development impacts in the future due to the effects of climate change; and

- Hydrology and Flood Risk – changes in rainfall frequency and intensity.

9.164 No further inter-related effects are considered likely to be significant.

Table 9.9: Summary of likely environmental effects on climate change

Receptor	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact	Significance of effect	Significant / Not significant
Construction phase						
Atmospheric concentration of GHG emissions	High	Changes to atmospheric concentration of GHG emissions	Long term	63,811 to 112,490 tCO_2e	Minor adverse	Not Significant
Operational phase						
Atmospheric concentration of GHG emissions	High	Changes to atmospheric concentration of GHG emissions	Long term	-83,100 to -988,234 tCO_2e (avoided emissions)	Beneficial	Significant
Effects as a result of climate change	n/a	Flood risk, high temperatures, storms affecting power transmission and building damage	Long term	See risk assessment	See risk assessment	Not significant
Decommissioning						
Atmospheric concentration of GHG emissions	High	Changes to atmospheric concentration of GHG emissions	Long term			
Effects as a result of climate change	n/a	Climatic changes impacting decommissioning activities.	Short term	n/a	Negligible	Not significant
Whole life						
Atmospheric concentration of GHG emissions	High	Changes to atmospheric concentration of GHG emissions	Long term	24,641 to -906,612 tCO_2e (avoided emissions) and 3 year payback period (under residual energy mix scenario)	Beneficial	Significant

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10 SOILS

Introduction

10.1 The Proposed Development involves approximately 136 ha of mostly agricultural land. Much of this area was open cast mined until 1964, and was infilled subsequently. The land is grassland, grazed predominantly, and some arable land.

10.2 The Site is shown on the Predictive Agricultural Land Classification (ALC) maps produced by the Welsh Government as mostly subgrade 3b "moderate" quality, with areas of predictive subgrade 3a "good" quality and Grade 2 mostly in the northern part of the site. Detailed ALC surveys have been carried out over the areas shown as potentially Grades 2 and 3a. The boundary of the site was amended to exclude any good quality land. All of the site is Subgrade 3b based on the predictive ALC and as a result of survey.

10.3 In a response to the Scoping Opinion the Soil, Peatland and Agricultural Land Use Planning Unit of the Welsh Government set out (20th July 2023) that the effects on soil functions should be considered as part of the ES. It was recognised that there is no "Best and Most Versatile" Agricultural Land (BMVAL) involved in the Proposed Development.

10.4 This Chapter therefore describes the agricultural effects, in particular on land quality, and sets out how soils have been assessed and are affected as part of the Proposed Development.

10.5 This Chapter has referenced, in particular:

(i) the Agricultural Land Classification survey (ALC) contained within **Appendix 10.2**;

(ii) the Scoping Direction Response by the Soil, Peatland and Agricultural Planning Unit dated 20th July 2023;

(iii) the IEMA Guide "A New Perspective on Land and Soils in Environmental Impact Assessment" (February 2022);

(iv) the Welsh Government Predictive Agricultural Land Classification Map (version 2), and the related Guidance Note (v2.1), and Frequently Asked Questions (v2);

(v) the Construction Code of Practice for the Sustainable Use of Soils, Defra (2009);

(vi) the Impact of Solar Photovoltaic (PV) sites on agricultural soils and land quality, ADAS/Welsh Government (March 2023);

(vii) the Agricultural Land Classification: Plas Power Solar Farm, Amet Property (issue 2, 7th November 2022), (the ALC report contained with **Appendix 10.2**).

Assessment Methodology

10.6 This section explains why agricultural considerations are important, and how they have been assessed.

Planning Policy Context

Future Wales: The National Plan 2040

10.7 Future Wales was published in 2021. The document recognises that productive land is a vital resource. The Best and Most Versatile agricultural land, which is defined as land in ALC Grades 1, 2 and 3a, is mapped on page 27.

10.8 Policy 17 addresses Renewable and Low Carbon Energy and Associated Infrastructure, noting strong support for the principle of developing renewable and low carbon energy. There is no mention of agricultural land quality in this section.

10.9 Policy 18 addresses Developments of National Significance (DNS). It notes that DNS development will be permitted subject to 11 criteria. None of these specifically mention agricultural land, although criterion 10 refers to the sustainable use of resources needed for or generated by the development.

Planning Policy Wales

10.10 Planning Policy Wales (Edition 12, 2024) (PPW) defines the "best and most versatile agricultural land" (BMV) in paragraph 3.58 as that falling within Grades 1, 2 and 3a of the Agricultural Land Classification (ALC). Such land is a finite resource which should be conserved for the future.

10.11 There is no bar on development on such land, but the policy advises that "**considerable weight should be given to protecting such land from development because of its special importance**".

TAN 6 (2010)

10.12 Technical Advice Note 6 (TAN 6) "Planning for Sustainable Rural Communities" sets out further advice in section 6. TAN 6 is now almost 14 years old, but advises that "**once agricultural land is developed, even for "soft" uses such as golf courses, its return to agriculture as best and most versatile agricultural land is seldom practicable**" (paragraph 6.2.2).

10.13 Paragraphs 6.2.6 to 6.2.9 advise on other relevant considerations, notably:

- effects of severance and fragmentation on farm structure;
- effects on buildings and fixed infrastructure;
- impacts on irrigation, where practised;
- wider effects, such as field underdrainage.

10.14 Annex B sets out the procedural requirements for consultation with the Welsh Government for development which "would involve the loss of 20 hectares or more of Grades 1, 2 or 3a agricultural land, or a loss which is less than 20 ha but is likely to lead to further losses amounting cumulatively to 20 hectares or more".

Local Policy

10.15 The Wrexham County Borough Local Development Plan 2013 – 2028 (adopted 20th December 2023) does not contain a specific policy on agricultural land. Policy SP14 Natural Environment will only permit development where it seeks to conserve and enhance the natural environment including (inter alia) the quality of soils.

Relevant Guidance

10.16 The Welsh Government has produced a predictive ALC map and it is accompanied by a number of documents including a "**Guidance Note**" (version 2.1, May 2021). This refers to the predictive map and sets out when field survey is required, which is where land is shown as potentially of Grades 1, 2 and 3a.

10.17 The "**ALC: Frequently Asked Questions**" (May 2021) document explains that "**normal agricultural management will rarely, if ever, affect the ALC grading of land**". The ALC is based on long-term physical and chemical limitations, and current or historic agricultural management does not affect grade. "**ALC grade could potentially only be improved by very major and expensive interventions, well beyond the scope of normal agricultural works**."

10.18 The Environmental Assessment has also drawn on the guidance from the IEMA guide "A New Perspective on Land and Soil in Environmental Impact Assessment" (February 2022)

Study Area

10.19 The Study Area is the Site, shown in **Figure 1.1.** There will be no development that will affect agricultural land or soils beyond the boundary of the Site.

Baseline Methodology

10.20 The majority of the Site is shown as predictive subgrade 3b. There is no requirement to survey such land.

10.21 Parts of the northern areas originally considered are shown on the predictive ALC as potentially Grade 2 and subgrade 3a. Therefore these have been the subject of a detailed ALC survey. This survey has been validated by the Welsh Government, who have confirmed that the survey accords with the ALC Guidelines (MAFF, 1988). The ALC survey has identified that almost all of the land identified as predictive ALC Grade 3a is actually subgrade 3b or 4. A small area (1.6 ha) of subgrade 3a was identified, and this has since been excluded from the Proposed Development.

Consultation

10.22 The consultation response to the scoping request (Addendum, 17th October 2023) has scoped soils into the ES.

Table 10.1: Consultation Responses Relevant to this Chapter

Date	Consultee and Issues Raised	How/ Where Addressed
Scoping Direction		
20th July 2023	LQAS: Policy 18 of NDF Future Wales is relevant.	Considered in the policy context and in this Chapter.
20th July 2023	LQAS: land is mostly subgrade 3b and field survey is not required. PPW paras 3.58 and 3.59 not applicable in this case.	The land quality is recorded and reported and assessed, in ES terms in this Chapter, especially its relationship to soils and soil handling.
20th July 2023	LQAS: the potential effects on soil functions from the construction, operation and decommissioning phases need explaining and considering, including a Soil Management Scheme.	An outline Soil Resource and Management Plan (oSRMP) has been produced and is part of the application documentation (please refer to **Appendix 10.1**). The effects on soils are considered in this Chapter.
Scoping Direction Addendum		
17th October 2023	PEDW. Based on the comments of LQAS, soil is scoped in.	Soil is considered in the Chapter.
17th October 2023	PEDW. Based on LQAS comments, the methodology should be explained and a soil management scheme included.	Included in this Chapter.

Assessment Criteria and Assignment of Significance

10.23 The assessment of receptor sensitivity, the magnitude of impacts and the resultant significance of effects draws heavily on the methodology set out by IEMA in their Guide “A New Perspective on Land and Soil in Environmental Impact Assessment” (February 2022).

10.24 The IEMA Guide is considered as industry best practice, but it is noted that because it has introduced a category of “very high” sensitivity in practice it has resulted in a noticeable increase in the significance of effects, especially where land of BMV quality is involved, over most pre-IEMA

assessments. Under the IEMA Guide, land of Grades 1, 2 and 3a is identified as of very high sensitivity. The loss of any amount of BMV land from 0.1 ha to 5 ha classes as a low magnitude impact, but still qualifies as a moderate significant effect.

10.25 Consultation with LQAS on losses of BMV is not triggered until 20 ha are involved. Approximately 19.1% of Wales is predicted to be of BMV quality. Accordingly in this assessment it is only effects that are of "major" or "major-moderate" in the tables below, which are considered significant in EIA terms. This means that losses of 5 ha or more of BMV are recorded as significant.

10.26 The IEMA guide sets out soil sensitivity. The Field Capacity Days (days when the soil is replete with water and cannot absorb any more) for this area is 207 days, so the relevant soil sensitivities are also shown below. This describes the susceptibility of soils to being damaged if moved or trafficked.

10.27 The following tables summarise the IEMA guidance.

Receptor Sensitivity/Value

Table 10.2: Definitions of Sensitivity

Sensitivity	Typical Descriptors
Very High	Land of ALC grades 1, 2 and 3a
High	High clay soils
Medium	Land of ALC subgrade 3b
	Medium textured soils
Low	Land of ALC grades 4 and 5.
	Soils with a high sand fraction
Negligible	Indirect or unproven links

Magnitude of Impact

Table 10.3: Definitions of Magnitude

Receptor	Magnitude
High	The loss from permanent sealing or land quality downgrading, or loss of soil functions, of more than 20 ha
Medium	The loss from permanent sealing or land quality downgrading, or loss of soil functions, of between 5 and 20 ha
Low	The loss from permanent sealing or land quality downgrading, or loss of soil functions, of less than 5 ha
Negligible	No discernible loss or reduction of land or soil functions.

Table 10.4: Significance Assessment Matrix

Sensitivity	Magnitude of Impact				
	No Change	Negligible	Low	Medium	High
Negligible	No change	Negligible	Negligible	Negligible	Negligible
Low	No change	Negligible	Negligible	Minor	Minor
Medium	No change	Negligible	Minor	Minor	Moderate

Sensitivity	Magnitude of Impact				
	No Change	Negligible	Low	Medium	High
High	No change	Negligible	Minor	Moderate	Major – Moderate
Very high	No change	Negligible	Moderate	Major – Moderate	Major

Limitations of the Assessment

10.28 Only those parts of the Site shown as predictive ALC Subgrade 3a have been surveyed. No ALC is required for areas of predictive ALC Subgrade 3b. Accordingly at this stage the level of soil survey across the areas identified as subgrade 3b on the Welsh Government's Predictive ALC, is limited. No ALC field survey was required for this area, and as set out in the outline Soil Resources Management Plan (oSRMP) (**Appendix 10.1**) further field testing will be required when preparing a full SRMP, which can be controlled by condition.

Baseline Environment

10.29 **Land Quality**. The land quality across the Site is subgrade 3b or Grade 4. This has been identified from the predictive ALC and, in those areas identified potentially falling into subgrade 3a or Grade 2, by field survey. The ALC field survey has been validated by the Welsh Government LQAS.

10.30 The field survey identified a small area of 1.6 ha of subgrade 3a.

10.31 **Soils.** The soils across the Site are shown on the 1:250,000 Soil Survey of England and Wales: Sheet 2 "Wales" (1983) as comprising Brickfield 2 and Nercwys soils. Parts of the site have been restored following opencast mining.

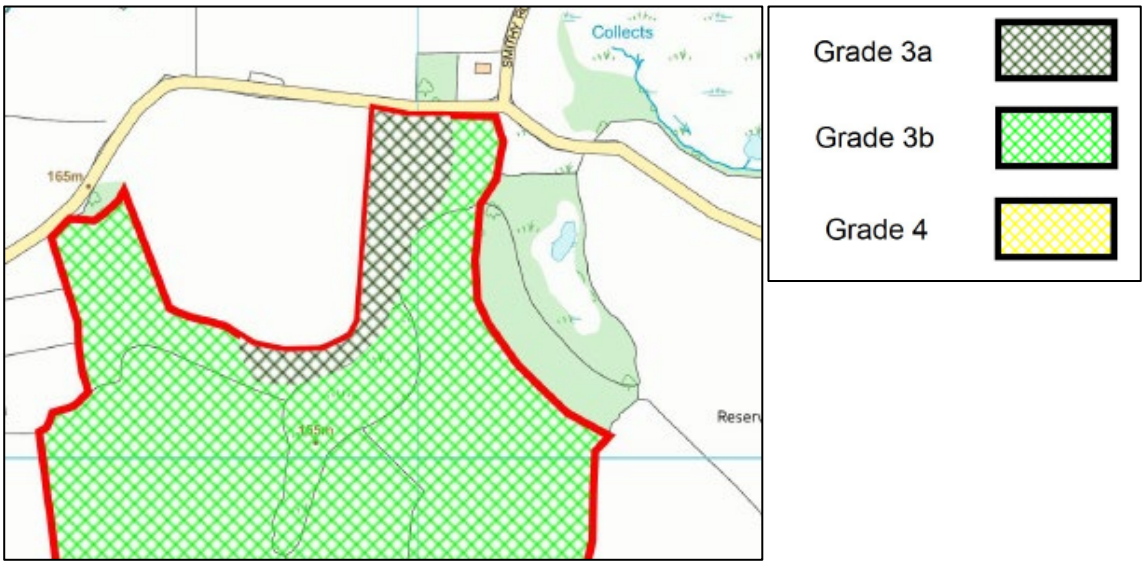
10.32 The field survey of part of the Site identified soils to be mostly a medium clay loam, occasionally heavy clay loam, generally stony. In places soil depth was shallow. The location of the 29 sample points is shown on Appendix 1 of the ALC (Amet Property, 2022) (**Appendix 10.2**).

10.33 The future baseline is not anticipated to change.

Mitigation Measures Adopted as Part of the Project

10.34 An area of 1.6 ha was identified from field survey to be subgrade 3a "good" quality land. This involved a small strip of land bordering the northern boundary of the Site. The design of the Proposed Development was amended to exclude this area. The area excluded is the subgrade 3a, shown below.

*Insert 1: Extract from the ALC Survey Report (**Appendix 10.2**) (Note: red line boundary is of extent of ALC survey, not extent of Proposed Development site boundary)*



10.35 Therefore the effect on BMV has been minimised by design, with BMV excluded from the Proposed Development. In addition, an outline Soil Resources Management Plan (oSRMP) (**Appendix 10.1**) has been produced to ensure good management of soils.

Assessment of Construction Effects

10.36 This section first describes the construction process then assesses the effects of development on the land quality and in particular the soils.

10.37 The soil resource, construction process and likely effects are discussed in greater detail in the outline Soil Resource and Management Plan (**Appendix 10.1**).

10.38 The installation stage has a limited effect on soils so long as the works are carried out when conditions are suitable. Soils across the Site are expected to be wet for about 200 days in any year. There will be limited opportunities for landwork involving moving soils (e.g. to construct tracks) between late October and early April, and greater care will be needed if soils are to be worked in this period.

10.39 Normally construction compounds and access tracks are constructed first. Both involve the removal of topsoil to a depth of about 30cm, which will be stored for reuse. In the case of the construction compounds the soil will be stored adjacent to the compound. With the tracks the amount of topsoil is limited (about 1 cubic metre per metre length of track) and this will normally be stored along the edge of the track so that it can be used at decommissioning to restore the land.

10.40 An example of a construction compound, newly created, is shown below.

Photo 10.1: Construction Compound



10.41 The installation of the solar panels does not involve disturbance to the soil. The legs are knocked in by small, lightweight machines, and the framework and panels are then bolted on. The following photograph illustrates the type of machinery used to insert the legs.

Photo 10.2: Example of Solar PV Leg Installation



10.42 The framework is then delivered, usually by tractor and trailer, and lifted off by hand and bolted together. The panels then follow and are also bolted on by hand. This causes minimal impact on soils, as the vehicles are not particularly large, provided soils are adequately dry, as shown below.

Photo 10.3: Examples After Panels Added



10.43 There will be trenches running from the end of each table of panels back to the inverters, but these are narrow trenches and soil will be removed and replaced in the same order, minimising the effects on soil profiles and structures.

10.44 Bases for small items of fixed equipment (switchgear substations, transformers and inverters, for example) will be constructed similarly to the tracks described above, and topsoil stored for replacement at decommissioning. An example is shown below.

Photo 10.4: Example of a Typical Inverter



10.45 The BESS facility will involve earthworks over an area of approximately 0.7 ha. This will be built at a later date. This is potentially restorable on decommissioning, but given the more extensive excavations required to level the area, it is considered to be irreversibly downgraded or sealed for the purposes of this assessment.

Effect on Land Quality.

10.46 The effects on land quality are limited. Across the areas for solar PV arrays there is no adverse effect on land quality, as there will be no sealing or land quality downgrading. In those areas the effect is negligible.

10.47 There are areas where soils are disturbed, to create tracks, bases etc, and for the BESS. These areas are shown in the table below.

Table 10.5: Measurement of Land Affected

Item	Calculation	Area (ha)
Access tracks	c. 6500m at 3.5m wide	2.3
Inverters	26 no x 40 sqm	0.1
Transformers	26 no x 20 sqm	0.05
Switchgear substation	Measured	0.05
BESS	To fence line	0.7
Total	-	3.2

10.48 There will be a temporary loss, for the duration of the Proposed Development, of approximately 2.5 ha of Subgrade 3b land. This is a minor magnitude impact on a resource of medium sensitivity, which is of minor adverse significance.

10.49 There will also be a permanent loss of approximately 0.7 ha of Subgrade 3b for the BESS, which is also a minor magnitude impact on a resource of medium sensitivity, which is of minor adverse significance.

Effect on Soils

10.50 The soils across most areas are medium or heavy clay loam, and therefore care will be taken to only move these soils when they are suitably dry. The passage of construction vehicles will be limited to dry periods so far as practicable.

10.51 Across the majority of the Site, where there will be solar PV arrays, there will be no loss or damage to soils.

10.52 The soils in the solar PV array areas will be of medium or high sensitivity, to be determined by further survey at the SRMP stage. The magnitude of impact, however, following the oSRMP will be negligible, so the overall significance will be negligible, which is not significant.

10.53 The amount of soil that will be temporarily sealed, for the duration of the operational phase, is estimated at 2.5 ha. This will be an adverse effect of low magnitude (<5ha) on a resource of medium sensitivity, which is an adverse effect of minor significance, which is not significant.

10.54 Welsh Government research has identified that the biggest risk to ALC grading, and soils, from solar PV sites is from compaction (WG 2023), and that a good soil resource and management plan is essential to minimise effects (the impact of solar PV sites on agricultural soils and land quality, 2023). The avoidance of deep compaction will be achieved by following the Soil Resources Management Plan.

10.55 The effect on soils should be not significant. Most of the topsoil is expected to be of medium clay loam texture, which in an area of <225 Field Capacity Days (FCD) (when soils are saturated) is identified by IEMA as of medium sensitivity (medium resilience to structural damage). Some areas may be heavy clay loams, which would be of high sensitivity (low resilience to structure damage). These areas will be mapped as part of a Soil Resources Management Plan deliverable by condition. With careful handling the effect on these high clay soils will be low or medium magnitude (<20 ha) and of minor or moderate adverse significance, which is not significant.

10.56 The soil handling methodology is set out in the outline Soils Resources Management Plan (**Appendix 10.1**).

Further Mitigation

10.57 No further mitigation is required.

Future Monitoring

10.58 No future monitoring is required.

Accidents and/or Disasters

10.59 There are no construction phase accidents or disasters likely to affect ALC grade or soils.

Assessment of Operational Effects

10.60 The operational effects will be negligible. The soils will not be disturbed, and areas that were previously in arable use will benefit from being in long-term grassland use.

10.61 There is very limited need for vehicles to travel over the land during the operational phase. Sheep will graze the areas, and occasionally stockman or panel maintenance vehicles will need to drive between the panels, but this is unlikely to happen when the land is wet (as they would get stuck). Panel cleaning happens usually annually at the start of the summer, and so when conditions are suitable for vehicle passage.

10.62 **Land Quality**. There will be no discernible effect on land quality during the operational stage. The effect is negligible, which is not significant.

10.63 **Soils**. Soil disturbance will be minimal and non-damaging during the operational phase. The effect will be negligible, which is not significant.

Further Mitigation

10.64 No further mitigation is required.

Future Monitoring

10.65 No future monitoring is required.

Accidents/Disasters

10.66 No operational-phase accidents or disasters are anticipated that would affect soils or land quality.

Assessment of Decommissioning Effects

10.67 This section describes decommissioning. Advice on soil management for that period is provided in the outline Soil Resources Management Plan (**Appendix 10.1**).

10.68 The decommissioning stage is very important. Research published by the Welsh Government identifies that the biggest risk to soils and land quality is from compaction, so the timing of decommissioning, and the handling of soils, is of high importance.

10.69 The planning consent should allow adequate flexibility in the decommissioning phase to enable the panels to be dismantled and removed, and the tracks and bases to be removed and the soils returned, when conditions are ideal. This may take more than one season, avoiding the winter periods.

10.70 The panels will be disconnected, unbolted and removed, and the framework unbolted and removed. Panel legs will then be pulled out of the ground, and removed. Because the machinery will need to pull the legs upwards, there will be a compensatory downward pressure from the machines, so this needs to take place when soils are dry to avoid causing compaction. This is likely to involve a shorter time period than for insertion, probably May to September. The timing will need to be reviewed closer to decommissioning because the effects of climate change may have altered the time periods when soils are suitably dry.

10.71 Cabling can be removed in the same manner, but in reverse, as it was installed. Deeply-buried cabling could be left in situ, as that would be less disruptive to soils then retrenching, or removed. The effect of either will be negligible.

10.72 Areas of hardstanding, tracks etc will be removed. The topsoil that has been stored can then be replaced, and the ground cultivated and seeded.

10.73 **Land Quality**. Land quality will not be affected unless deep compaction is caused. This can readily be avoided by working only when soil conditions are suitable. Therefore the effect on land quality of removing the panels will be negligible, which is not significant.

10.74 **Soils**. Soil damage from trafficking can be avoided by timing the works to periods when soil conditions are suitable. This reduces the impact to negligible, which is not significant.

Potential Changes to the Assessment as a Result of Climate Change

10.75 The Welsh Government publication under the Capability, Suitability and Climate Programme "The Effect of Climate Change on Agricultural Land Classification (ALC) in Wales" (March 2020, report code CSCP05) predicts the effects of climate change on land quality. The sections on drought and soil wetness suggest that climate change will not significantly affect ALC grade in this part of Wales, although after 2050 land quality generally is predicted to get poorer.

Assessment of Cumulative Effects

10.76 The assessment considers the effects on soils and land quality within the Site only. These are specific to the Site. There are no cumulative effects with other proposals as they will not be affected by the Proposed Development.

Inter-relationships

10.77 The conversion of some arable land to grassland, and the reductions in the intensity of grazing, will have benefits for soil heath and soil biodiversity. This will be a minor benefit, which is not significant. It will be a benefit limited to the soils, and so there is no inter-relationship benefit with other chapters.

Summary of Effects

10.78 The effects of construction will be limited to those areas disturbed to create tracks and substation bases, and in due course the BESS. The installation of the solar PV arrays does not adversely affect soils or land quality, and is a negligible effect. The temporary effects from creating tracks and substation bases (2.5 ha) will result in the temporary sealing of less than 5ha of Subgrade 3b, which is a low magnitude effect on a resource of medium sensitivity, which is a minor significance effect. The temporary loss of less than 1 ha of Subgrade 3b land for the BESS will also be a low magnitude effect on a resource of medium sensitivity, which is a minor significance effect.

10.79 The operational effects will be negligible. There will be no additional effect on soils or land quality.

10.80 The decommissioning will not adversely affect soils and land quality. Therefore the magnitude of effect is negligible, and the significance of effect is negligible, which is not significant.

Table 10.6: Summary of Likely Environmental Effects on Soils

Receptor	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact	Significance of effect	Significant / Not significant
Construction phase						
Soils	Medium or high	Adverse effect on soil function	Short / medium	Negligible	Negligible	Not significant
Agricultural land quality	Medium	Temporary sealing or irreversible downgrading	Medium	Low	Minor adverse	Not significant
Agricultural land quality	Medium	Permanent sealing/ downgrading	Low	Low	Minor adverse	Not significant
Operational phase						
Soils	Medium or high	Structural damage	Short / medium	Negligible	Negligible	Not significant

References

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